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January 31, 2013

Docket Control
Arizona Corporation Commission
1200 West Washington
Phoenix, Arizona 85007

RE: Arizona Public Service Company Ten-Year Transmission System Plan
Docket No. E-00000D-13-0002

In compliance with A.R.S. § 40-360.02, enclosed please find Arizona Public Service Company's ("APS") 2013-2022 Ten-Year Plan for major transmission facilities (as Attachment A), which includes the internal planning criteria and system ratings as required by Arizona Corporation Commission ("ACC") Decision No. 63876 (July 25, 2001) and the Renewable Transmission Action Plan (as Attachment B).

> IT IS FURTHER ORDERED that Transmission Owners are required to file, with their Ten-Year Plans, internal planning criteria and systems rating with limiting elements identified. (Decision No. 63876, p.3).

The 2013-2022 Ten-Year Plan describes planned transmission lines of 115 kV or higher that APS may construct over the next 10 years. This Ten-Year Plan includes approximately 191 miles of new 500 kV transmission lines, 78 miles of new 230 kV transmission lines, 6 miles of new 115kV transmission lines, and 10 new bulk transformers. The APS investment needed to construct these projects is currently estimated to be approximately $612 million. These new transmission projects, coupled with additional distribution and sub-transmission investments, will support reliable power delivery in APS's service area, Arizona, and in the western United States.

If you have any questions regarding this information, please contact me at (602)250-2661.

Sincerely,

Jeffrey W. Johnson

JJ/cd

cc: Jodi Jerich
Janice Alward
Lyn Farmer
Steve Olea
John Foreman
Brian Bozzo
Terri Ford
Patrick Quinn

Arizona Corporation Commission
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AZ CORP COMMISSION
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Attachment A

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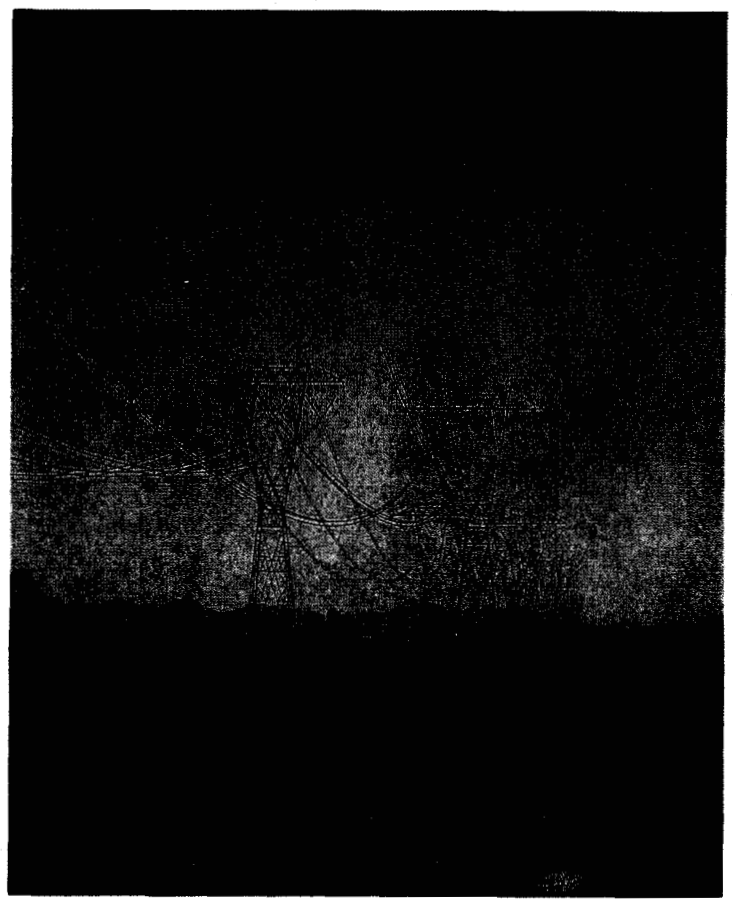
ARIZONA PUBLIC SERVICE COMPANY
2013–2022
TEN-YEAR TRANSMISSION SYSTEM PLAN

Prepared for the
Arizona Corporation Commission



January 2013

ARIZONA PUBLIC SERVICE COMPANY
2013 - 2022
TEN-YEAR TRANSMISSION SYSTEM PLAN

TABLE OF CONTENTS

ARIZONA PUBLIC SERVICE COMPANY
2013–2022
TEN-YEAR TRANSMISSION SYSTEM PLAN

GENERAL INFORMATION

Pursuant to A.R.S. § 40-360.02, Arizona Public Service Company ("APS") submits its 2013–2022 Ten-Year Transmission System Plan ("Ten-Year Plan"). Additionally, pursuant to Arizona Corporation Commission ("Commission") Decision No. 63876 (July 25, 2001) concerning the First Biennial Transmission Assessment ("BTA"), APS is including with this filing its Transmission Planning Process and Guidelines and maps showing system ratings on APS's transmission system. The Transmission Planning Process and Guidelines outline generally APS's internal planning for its high voltage and extra-high voltage ("EHV") transmission system, including a discussion of APS's planning methodology, planning assumptions, and its guidelines for system performance. The system ratings maps show continuous and emergency system ratings on APS's EHV system, and on its Metro, Northern, and Southern 230kV systems. APS also includes its Renewable Transmission Action Plan as an attachment to this filing. The Ten-Year Plan is conducted and filed annually with the Commission.

This 2013–2022 Ten-Year Plan describes planned transmission lines of 115kV or higher voltage that APS may construct or participate in over the next ten-year period. Pursuant to A.R.S. § 40-360(10), underground facilities are not included. There are approximately 191 miles of 500kV transmission lines, 78 miles of 230kV transmission lines, 6 miles of 115kV transmission lines, and 10 bulk transformers contained in the projects in this Ten-Year Plan. The total investment for the APS projects and the anticipated APS portion of the participation projects

as they are modeled in this filing is estimated to be approximately $612 million.[1] The following table shows a breakdown of the projects contained in this Ten-Year Plan.

Description	Projects in Ten-Year Plan
500kV transmission lines	191 miles
230kV transmission lines	78 miles
115kV transmission lines	6 miles
Bulk Transformers	10
Total Investment	$612 million[1]

In addition to the new projects described in this Ten-Year Plan, included is a list of transformer replacements and additions consistent with the Commission's Sixth BTA (Decision No. 72031 dated December 10, 2010) to include information regarding planned transmission reconductor projects and substation transformer replacements. At this time, APS does not have any plans for reconductoring any existing transmission lines. These types of plans often change as they typically are in direct response to load growth or generator interconnections. Therefore, in-service dates for transformer replacement/additions and transmission reconductor projects change to reflect the load changes in the local system. Also, there may be projects added throughout the course of the planning year to accommodate new generator interconnections.

[1] The first three years of these additions are included in the Capital Expenditures table presented in the "Liquidity and Capital Resources" section of APS's 10-K filing along with other transmission costs for new sub-transmission projects (69kV) and transmission upgrades and replacements. The Capital Expenditures table shows $556M for 2013 thru 2015.

Bulk Transformer Additions/Replacements

Description	Year
Black Peak 161/69kV Transformer Replacement	2013
Buckeye 230/69kV Transformer #2 Replacement	2016
Raceway 230/69kV Transformer #2	2018
Palm Valley 230/69kV Transformer #2	2019
Yavapai 230/69kV Transformer #2	2021
El Sol 230/69kV Transformer #3	TBD
Lincoln St. 230/69kV Transformer #2	TBD
Scatter Wash 230/69kV Transformer #2	TBD

Some of the facilities reported in prior Ten-Year plan filings have been completed. Others have been canceled or deferred beyond the upcoming ten-year period and are not included in this Ten-Year Plan. The projects that have "To Be Determined" in-service dates are projects that have been identified, but are either still outside of the ten-year planning window or have in-service dates that have not yet been established. They have been included in this filing for informational purposes. A summary of changes from last year's Ten-Year plan is provided below, along with a list of projects that have been added to this year's Ten-Year Plan. Also, a section is included that briefly describes projects still in the feasibility planning phase.

For convenience of the reader, APS has included system maps showing the electrical connections and in-service dates for all overhead transmission projects planned by APS for Arizona, the Phoenix Metropolitan Area, and the Yuma area. Written descriptions of each proposed transmission project are provided on subsequent pages in the currently expected chronological order of each project. The line routings shown on the system maps and the descriptions of each transmission line are intended to be general, showing electrical connections and not specific routings, and are subject to revision. Specific routing is recommended by the Arizona Power Plant and Transmission Line Siting Committee and ultimately approved by the Commission when issuing a Certificate of Environmental Compatibility and through subsequent

right-of-way acquisition. Pursuant to A.R.S. § 40-360.02(7), this filing also includes technical study results for the projects identified. The technical study results show project needs that are generally based on either security (contingency performance), adequacy (generator interconnection or increasing transfer capability), or both.

APS participates in numerous regional planning organizations and in the WestConnect organization. Through membership and participation in these organizations, the needs of multiple entities, and the region as a whole, can be identified and studied, which maximizes the effectiveness and use of new projects. Regional organizations in which APS is a member include the Western Electricity Coordinating Council ("WECC"), the Southwest Area Transmission Planning ("SWAT"), and WestConnect. The plans included in this filing are the result of these coordinated planning efforts. APS provides an opportunity for other entities to participate in future planned projects.

During the Fifth BTA the Commission ordered the respective utilities in Cochise County to "perform collaborative studies and file a report that establishes the long range system plan for Cochise County that is founded on the principle of providing continuity of service following a transmission line outage" (Decision No. 70635 dated December 11, 2008). As a participant in the SWAT-Southeastern Arizona Transmission Study ("SATS") subcommittee, APS worked with other stakeholders in Cochise County, as part of the Cochise County Study Group ("CCSG"), to develop a transmission plan to address the recommendations in the Fifth BTA. In its Decision in the Seventh BTA the Commission ordered that the CCSG participants "[s]uspend efforts to upgrade reliability to a continuity of service definition for Cochise County… "[T]he CCSG participants ... continue to monitor the reliability in Cochise Count[y], …, and propose any modifications that [the CCSG] deems to be appropriate in future ten-year

plans." As such, APS will continue to monitor the reliability in Cochise County and propose any appropriate modifications in future ten-year plans.

The Commission's Sixth BTA ordered that utilities include the effects of distributed generation and energy efficiency programs on future transmission needs. APS's modeled load, located in the Technical Study Report section of this filing, addresses these effects.

The projects identified in this Ten-Year Plan, with their associated in-service dates, will ensure that APS's transmission system meets all applicable reliability criteria. Changes in regulatory requirements, regulatory approvals, or underlying assumptions such as load forecasts, generation or transmission expansions, economic issues, and other utilities' plans, may substantially impact this Ten-Year Plan and could result in changes to anticipated in-service dates or project scopes. Additionally, future federal and regional mandates may impact this Ten-Year Plan specifically and the transmission planning process in general. This Ten-Year Plan is tentative only and is subject to change without notice at the discretion of APS (A.R.S. § 40-360.02(F).

CHANGES FROM 2012-2021 TEN-YEAR PLAN

The following is a list of projects that were changed or removed from APS's January 2012 Ten-Year Plan filing, along with a brief description of why the change was made.

- The in-service date for the Pinal Central – Sundance 230kV project has moved from an in service date of 2014 to a To Be Determined date. The projected growth in the region has been reduced over the last few years, therefore this project is not projected to be needed in the near-term plan horizon. APS will continue monitoring the system and plan the construction of this project when needed.

- APS is no longer participating in the Desert Basin – Pinal Central 230kV project. This is a project that is managed by SRP, who is still planning to move forward with the project. APS does not see a benefit to our customers by participating in this project at this time.
- APS filed an Application pursuant to A.R.S. § 40-252 with the Commission on October 18, 2012 for the North Valley 230kV Transmission Line Project(Case 120 Docket No. L-00000D-02-0120-0000). In its Application, APS has requested a ten year extension of the term of the CEC to construct both the Scatter Wash (formerly Misty Willow) and Avery substations, to cancel that portion of the CEC approving a double-circuit 230kV transmission line between the Westwing, Raceway and Pinnacle Peak substation, to approve a change of location of the Scatter Wash substation to the north side of the approved transmission line corridor and to use a modified interconnection structure that was not previously contemplated.

In-Service Date Changes

Project Name	**Previous In-Service Date**	**New In-Service Date**
Youngs Canyon 345/69kV project	2012	2013
Delaney-Palo Verde 500kV line	2013	2016
Delaney-Sun Valley 500kV line	2015	2016
Sun Valley-Trilby Wash 230kV line	2015	2016
Mazatzal loop in of Cholla-Pinnacle Peak 345kV line	2015	2017
North Gila – TS8 230kV Line	2015	2016
Morgan-Sun Valley 500kV line	2016	2018

The in-service dates shown in this table are based on load projections, not potential interconnections. New generation interconnections may accelerate the in-service date.

NEW PROJECTS IN THE 2013-2022 TEN-YEAR PLAN

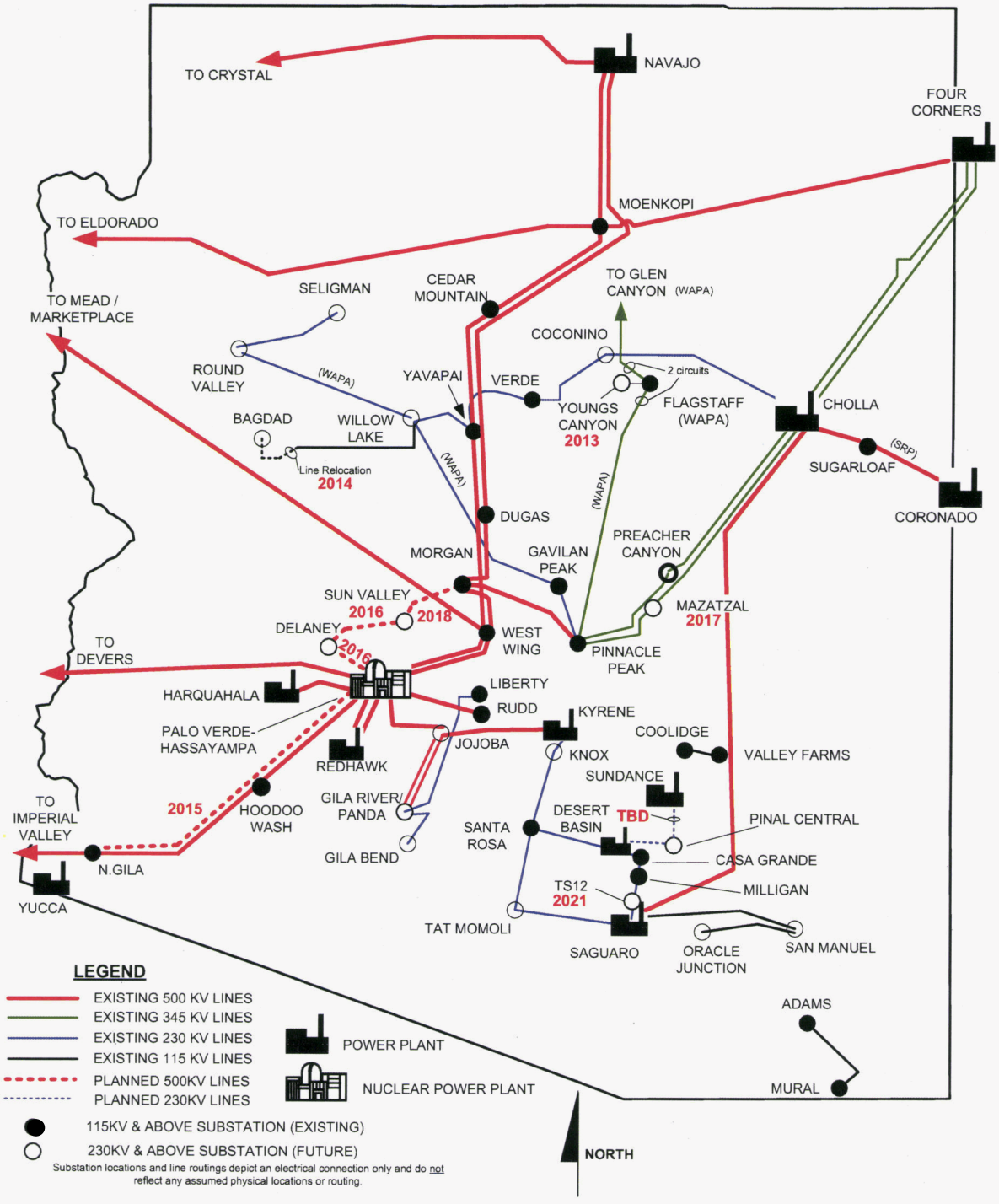
There are no new projects planned within the 2013-2022 Ten-Year Plan that were not in the 2012-2021 Ten-Year Plan.

CONCEPTUAL PROJECTS IN THE FEASIBILITY PLANNING PHASE

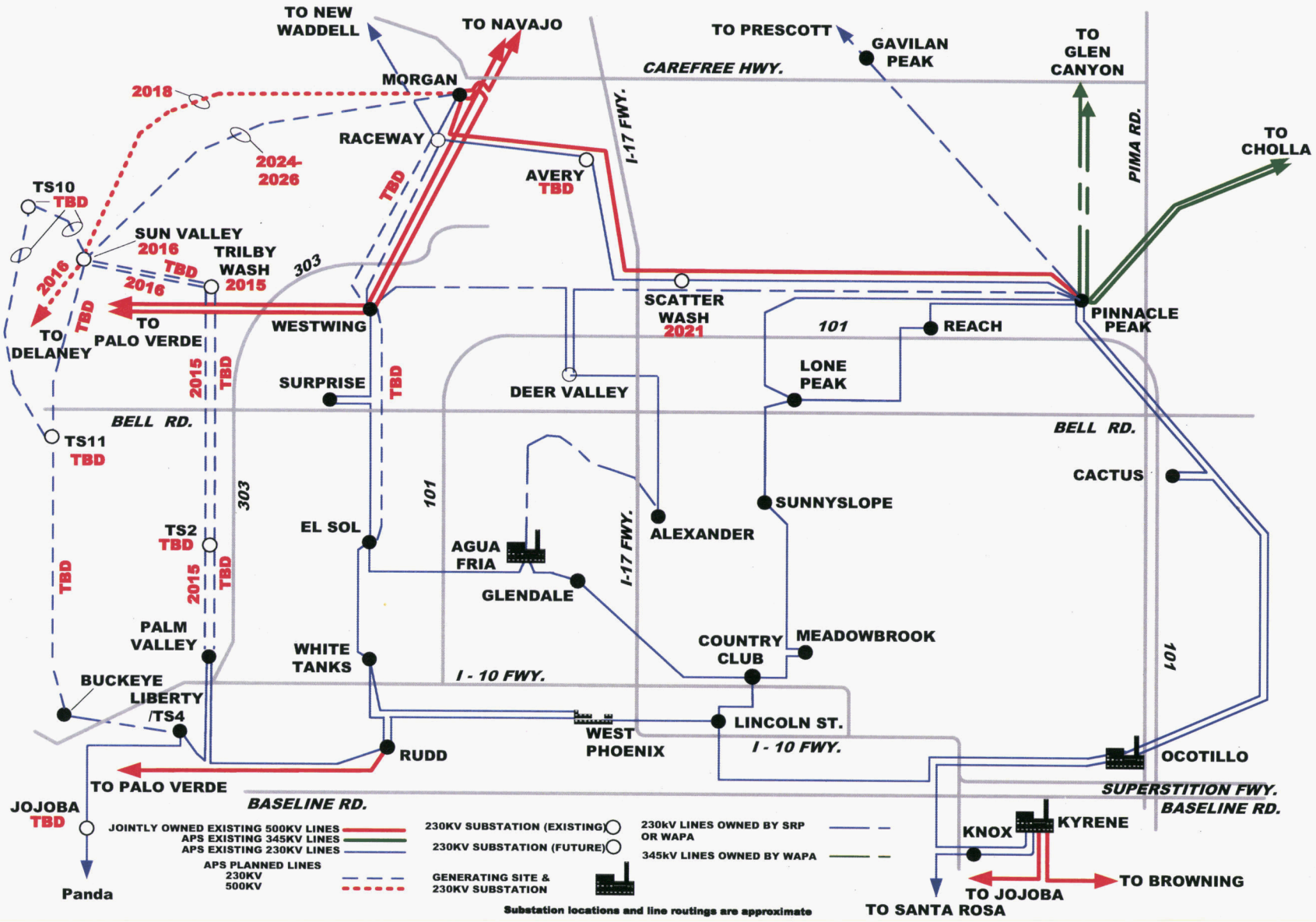
Palo Verde/Gila Bend Area To Valley Transmission Capacity

Additional transmission capacity will be studied from the Palo Verde/Gila Bend areas to the Phoenix load center. This transmission capacity is a robust component of the overall APS transmission and resource need. The areas around and west of Palo Verde as well as the Gila Bend area contain some of the best solar resources in the country. APS expects that at least a portion of the future solar resources specified in the APS Integrated Resource Plan (Docket No. E-00000A-11-0113) will be developed in relatively close proximity to these areas and will be supported by this transmission capacity. These areas also provide access to existing gas resources and, in the case of Palo Verde, potential new gas resources and market purchases.

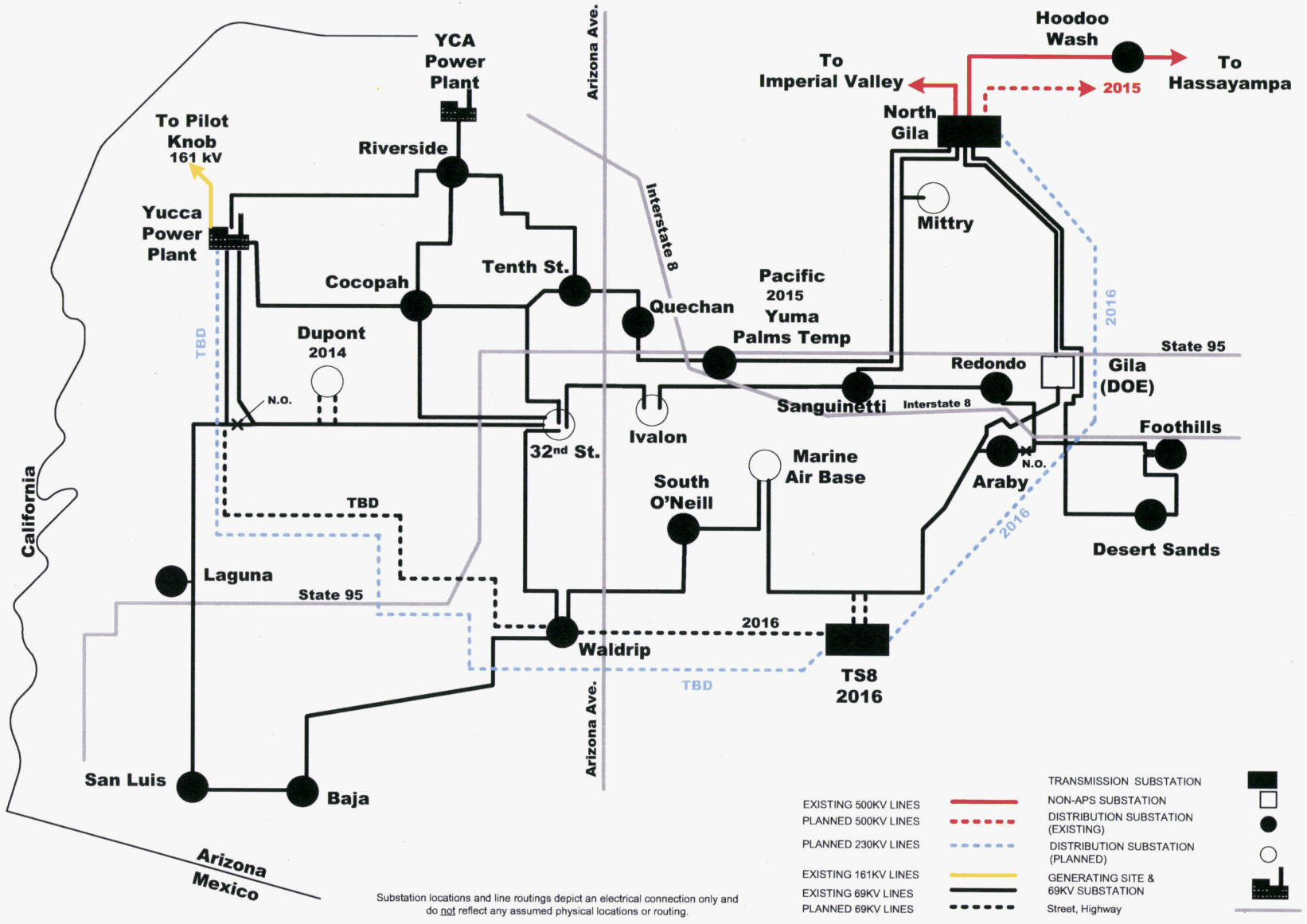
APS EHV & OUTER DIVISION 115/230 KV TRANSMISSION PLANS 2013 - 2022



PHOENIX METROPOLITAN AREA TRANSMISSION PLANS 2013-2022



Yuma Area Transmission Plans 2013-2022



Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2013

Line Designation	Youngs Canyon 345/69kV Interconnection at Western's Flagstaff 345kV switchyard
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	345kV AC
(b) Facility Rating	100 MVA
(c) Point of Origin	Western's Flagstaff 345kV switchyard; Sec. 24, T21N, R9E
(d) Intermediate Points of Interconnection	
(e) Point of Termination	A new Youngs Canyon 345/69kV substation to be in-service by 2013; Sec. 24, T21N, R9E
(f) Length	Less than 1 mile
Routing	A 345/69kV transformer will interconnect into Western's Flagstaff switchyard.
Purpose	This project is needed to provide the electrical source and support to the sub-transmission system in APS's northern service area. The project will provide increased reliability and continuity of service for the communities in northern Arizona.
Date	
(a) Construction Start	2011
(b) Estimated In Service	2013
Permitting / Siting Status	*A Certificate of Environmental Compatibility was deemed to be not required for this project. At the conclusion of a National Environmental Policy Act process ("NEPA"), a Finding of No Significant Impact was issued on 6/13/07 based on Environmental Assessment. Special Use Permit issued on 4/6/09.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2014

Line Designation	Bagdad 115kV Relocation Project
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	115kV AC
(b) Facility Rating	430 A
(c) Point of Origin	Bagdad Capacitor switchyard; Sec. 10, T14N, R9W
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Bagdad Mine substation; Sec. 31, T15N, R9W
(f) Length	Approximately 5.5 miles
Routing	Beginning at the existing APS capacitor switchyard and extending in a southwesterly direction for approximately 1.5 miles, then turning in a northwesterly direction approximately 4 miles to the existing Bagdad Mine substation. The project primarily crosses federal BLM lands, private lands (owned by the mine) and a short segment on Arizona State Trust Lands.
Purpose	Freeport McMoRan Inc. has future plans to expand the mine in the location of the existing 115kV transmission line. They have requested that APS move the line in a southerly direction beyond the limits of the planned expansion.
Date	
(a) Construction Start	2013
(b) Estimated In Service	2014
Permitting / Siting Status	*Certificate of Environmental Compatibility issued on 7/16/09 (Case No. 143, Decision No. 71217, Bagdad 115kV Relocation Project). An amendment to the original CEC was granted on 11/21/12, Decision No. 73586, expanding a portion of the project corridor on FMI property to accommodate rerouting this line.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2015

Line Designation	Palo Verde Hub – North Gila 500kV #2 Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	500kV AC
(b) Facility Rating	To be determined
(c) Point of Origin	Hassayampa switchyard
(d) Intermediate Points of Interconnection	
(e) Point of Termination	North Gila substation; Sec. 11, T8S, R22W
(f) Length	Approximately 110 miles
Routing	This line will generally follow the route of the existing Hassayampa - North Gila 500kV #1 line.
Purpose	This project will increase the import capability for the Yuma area and export/scheduling capability from the Palo Verde area to provide access to both solar and gas resources. This project will also allow the system to accommodate generation interconnection requests.
Date	
(a) Construction Start	2013
(b) Estimated In Service	2015
Permitting / Siting Status	*Certificate of Environmental Compatibility issued 1/23/08 (Case No. 135, Decision No. 70127, Palo Verde Hub to North Gila 500kV Transmission Line project).*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2015

Line Designation	Palm Valley – TS2 – Trilby Wash 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	3000 A
(c) Point of Origin	Palm Valley substation; Sec. 24, T2N, R2W
(d) Intermediate Points of Interconnection	TS2 substation to be in-service by TBD; Sec. 25, T3N, R2W
(e) Point of Termination	Trilby Wash substation to be in-service by 2015; Sec. 20, T4N, R2W
(f) Length	Approximately 12 miles
Routing	North from the Palm Valley substation, generally following the Loop 303 to Cactus Road, west on Cactus Road to approximately 191st Avenue, and then north on 191st Avenue to the Trilby Wash substation.
Purpose	This project will serve the need for electric energy in the western Phoenix Metropolitan area and additional import capability into the greater Phoenix Metropolitan area. The proposed second 230kV source for Trilby Wash provides improved system reliability and continuity of service for communities in the area; such as El Mirage, Surprise, Youngtown, Goodyear, and Buckeye. The first circuit is scheduled to be in-service for the summer of 2015; the in-service date for the second circuit will be evaluated in future planning studies. The in-service date for the TS2 substation is currently outside of the ten year planning horizon and will be continuously evaluated in future planning studies.
Date	
(a) Construction Start	2014
(b) Estimated In Service	2015
Permitting / Siting Status	*The Palm Valley-TS2 230kV line portion was sited as part of the West Valley South 230kV Transmission Line project and a Certificate of Environmental Compatibility was issued 12/22/03 (Case No. 122, Decision No. 66646). The Trilby Wash-TS2 230kV line portion was sited as part of the West Valley North 230kV Transmission Line project and a Certificate of Environmental Compatibility was issued 5/5/05 (Case No. 127, Decision No. 67828).*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2016[2]

Line Designation	Delaney – Palo Verde 500kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	CAWCD
Size	
(a) Voltage Class	500kV AC
(b) Facility Rating	To be determined
(c) Point of Origin	Palo Verde Switchyard
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Delaney Switchyard; Sec. 25, T2N, R8W
(f) Length	Approximately 15 miles
Routing	Generally leaving the Palo Verde Hub vicinity following the Palo Verde-Devers #1 and the Hassayampa-Harquahala 500kV lines to the Delaney Switchyard site in Sec. 25, T2N, R8W.
Purpose	This project is anticipated to interconnect generation projects at the Delaney switchyard. This line is also one section of a new 500kV path from Palo Verde around the western and northern edges of the Phoenix area and terminating at Pinnacle Peak. This is anticipated to be a joint participation project. APS will serve as the project manager.
Date	
(a) Construction Start	2011
(b) Estimated In Service	2016
Permitting / Siting Status	*Certificate of Environmental Compatibility issued 8/17/05 (Case No. 128, Decision No. 68063, Palo Verde Hub to TS5 500kV Transmission project). APS, as project manager, holds the CEC.*

[2] The previous in-service date of 2013 assumed there would be a resource developed at Delaney to utilize the project to effect a 2013 in-service date. Without such development to-date, the project is being listed with an in-service in 2016 with the Delaney-Sun Valley project per approval of the APS Renewable Transmission Action Plan in Decision No. 72057 (1/6/11), Docket No. E-01345A-10-0033.

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2016

Line Designation	Delaney – Sun Valley 500kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	CAWCD
Size	
(a) Voltage Class	500kV AC
(b) Facility Rating	To be determined
(c) Point of Origin	Delaney Switchyard; Sec. 25, T2N, R8W
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Sun Valley substation to be in-service by 2016; Sec. 29, T4N, R4W
(f) Length	Approximately 28 miles
Routing	Generally follows the Palo Verde-Devers #1 line until crossing the CAP canal. Then easterly, generally following the north side of the CAP canal to the new Sun Valley substation.
Purpose	This project will serve projected need for electric energy in the area immediately north and west of the Phoenix Metropolitan area. The project will increase the system reliability by providing a new transmission source to help serve the areas in the western portions of the Phoenix Metropolitan area. This is a joint participation project with APS as the project manager. It will also increase the import capability to the Phoenix Metropolitan area as well as increase the export/scheduling capability from the Palo Verde area to provide access to both solar and gas resources.
Date	
(a) Construction Start	2014
(b) Estimated In Service	2016
Permitting / Siting Status	*Certificate of Environmental Compatibility issued 8/17/05 (Case No. 128, Decision No. 68063, Palo Verde Hub to TS5 500kV Transmission project). APS, as project manager, holds the CEC.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2016

Line Designation	Sun Valley – Trilby Wash 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	3000 A
(c) Point of Origin	Sun Valley substation to be in-service by 2016; Sec. 29, T4N, R4W
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Trilby Wash substation to be in-service by 2015; Sec. 20, T4N, R2W
(f) Length	Approximately 15 miles
Routing	East from the Sun Valley substation along the CAP canal to approximately 243rd Ave., south to the existing 500kV transmission line corridor, and then east along the corridor to the Trilby Wash substation.
Purpose	This project is required to serve the need for electric energy in the western Phoenix Metropolitan area. Also, the project will provide more capability to import power into the Phoenix Metropolitan area along with improved reliability and continuity of service for communities in the area including El Mirage, Surprise, Youngtown, Buckeye, and unincorporated Maricopa county. The first circuit is scheduled to be in-service for the summer of 2016 and the in-service date for the second circuit will be evaluated in future planning studies.
Date	
(a) Construction Start	2014
(b) Estimated In Service	2016
Permitting / Siting Status	*Certificate of Environmental Compatibility issued 5/5/05 (Case No. 127, Decision No. 67828, West Valley North 230kV Transmission Line project).*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2016

Line Designation	North Gila – TS8 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	3000 A
(c) Point of Origin	North Gila substation; Sec. 11, T8S, R22W
(d) Intermediate Points of Interconnection	
(e) Point of Termination	TS8 230kV substation to be in-service by 2016; Sec. 20, T9S, R22W
(f) Length	Approximately 13 miles
Routing	In general the line will proceed south from the North Gila substation until County 6 ½ Street, where it will head east for approximately 1 mile. Then following the existing WAPA utility right-of-way south to County 9 ½ Street, where it will proceed east for approximately 0.3 mile before heading south on Avenue 10E. Then the route will proceed southwest adjacent to the UPRR and then adjacent to the A Canal until it turns south along the Yuma Area Service Highway alignment. The route then proceeds west along the County 13 ½ Street alignment to Avenue 5 ½E, where it will turn south to the TS8 termination point.
Purpose	This project serves the need for electric energy, improved reliability, and continuity of service for the greater Yuma area. This project is expected to be double circuit capable with one circuit in service in 2016 and the second circuit in service at a date to be determined.
Date	
(a) Construction Start	2014
(b) Estimated In Service	2016
Permitting / Siting Status	*Certificate of Environmental Compatibility issued 2/2/12 (Case No. 163, Decision No. 72801, North Gila to TS8 to Yucca 230kV Transmission Line project).*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2017

Line Designation	Mazatzal loop-in of Cholla – Pinnacle Peak 345kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	345kV AC
(b) Facility Rating	100 MVA
(c) Point of Origin	Cholla-Pinnacle Peak 345kV line; near Sec. 3, T8N, R10E
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Mazatzal substation to be in-service by 2017; Sec. 3, T8N, R10E
(f) Length	Less than 1 mile
Routing	The Mazatzal 345/69kV substation will be constructed adjacent to the Cholla-Pinnacle Peak 345kV line corridor.
Purpose	This project is needed to provide the electric source and support to the sub-transmission system in the area of Payson and the surrounding communities. Additionally, improved reliability and continuity of service will result for the communities in the Payson area.
Date	
(a) Construction Start	2016
(b) Estimated In Service	2017
Permitting / Siting Status	*Certificate of Environmental Compatibility issued on 5/4/11 (Case No. 160, Decision No. 72302, Mazatzal Substation and 345kV Interconnection Project).*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2018

Line Designation	Morgan – Sun Valley 500kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	CAWCD
Size	
(a) Voltage Class	500kV AC
(b) Facility Rating	To be determined
(c) Point of Origin	Sun Valley substation to be in-service in 2016; Sec. 29, T4N, R4W
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Morgan substation; Sec. 33, T6N, R1E
(f) Length	Approximately 38 miles
Routing	Generally the line will head north-northeast out of the Sun Valley substation and then east to the Morgan substation.
Purpose	This project will serve the electric energy needs in the northern Phoenix Metropolitan area. The project will also increase the reliability of the EHV system by completing a 500kV loop that connects the Palo Verde Transmission system, the Southern Navajo Transmission system, and the Southern Four Corners system. Additionally, the project will increase reliability by providing a second 500kV source for the Sun Valley substation and providing support for multiple Category C and D transmission contingencies. It will also increase the import capability to the Phoenix Metropolitan area, as well as increase the export/scheduling capability from the Palo Verde Hub area, which includes both solar and gas resources. This project is anticipated to be 500/230kV double-circuit capable.
Date	
(a) Construction Start	2015
(b) Estimated In Service	2018
Permitting / Siting Status	*Certificate of Environmental Compatibility issued on 3/17/2009 (Case No. 138, Decision No. 70850, TS5-TS9 500/230kV Project). APS applied for a right-of-way from the BLM for a portion of the project, which has been under NEPA review. The BLM released a Draft Environmental Impact Statement on 11/9/12.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2021

Line Designation	Scatter Wash loop-in of Pinnacle Peak-Raceway 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	3000 A
(c) Point of Origin	Pinnacle Peak-Raceway 230kV line; Sec. 8, T4N, R3E
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Scatter Wash substation; Sec. 8, T4N, R3E
(f) Length	Less than 1 mile
Routing	The Scatter Wash substation will be located adjacent to the Pinnacle Peak-Raceway 230kV line.
Purpose	This project is needed to provide electric energy in the northern portions of the Phoenix Metropolitan area as well as increase the reliability and continuity of service for these areas.
Date	
(a) Construction Start	2020
(b) Estimated In Service	2021
Permitting / Siting Status	*Certificate of Environmental Compatibility issued on 6/18/03 (Case No. 120, Decision No. 65997, North Valley Project. The Scatter Wash Substation was referred to as TS6 in Case 120). As described in the narrative section of this Ten-Year Plan, APS filed an Application pursuant to A.R.S. § 40-252 to extend the term of this CEC and amend it to conform with subsequent decisions and circumstances. An evidentiary hearing on APS's application is set for February 26, 2013.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2021

Line Designation	Saguaro (TS12): Relocate the 230kV yard and install a 230/69kV Transformer
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	188 MVA
(c) Point of Origin	Saguaro 230kV Substation; approximately Sec. 14, T10S, R10E
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Saguaro 230kV Substation; Sec. 14, T10S, R10E
(f) Length	N/A
Routing	N/A
Purpose	Relocate the Saguaro 230kV yard, install a 230/69kV transformer and extend a 69kV line from Saguaro to the proposed SE10 (Red Rock) substation. A new 69kV source is needed in the vicinity of the planned SE10 (Red Rock) substation to serve the projected local load.
Date	
(a) Construction Start	2020
(b) Estimated In Service	2021
Permitting / Siting Status	*It is not anticipated that a Certificate of Environmental Compatibility will be needed for this project.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

2024-2026

Line Designation	Morgan – Sun Valley 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	To be determined
(c) Point of Origin	Sun Valley substation to be in-service by 2016; Sec. 29, T4N, R4W
(d) Intermediate Points of Interconnection	To be determined
(e) Point of Termination	Morgan substation; Sec. 33, T6N, R1E
(f) Length	Approximately 38 miles
Routing	This line will be co-located with the Sun Valley to Morgan 500kV line, which generally heads north-northeast out of the Sun Valley substation and then east to the Morgan substation.
Purpose	This project is needed to provide a transmission source to serve future load that emerges in the currently undeveloped areas south and west of Lake Pleasant. This line will be co-located with the Sun Valley-Morgan 500kV line.
Date	
(a) Construction Start	2024-2026
(b) Estimated In Service	2024-2026
Permitting / Siting Status	*Certificate of Environmental Compatibility issued on 3/17/2009 (Case No. 138, Decision No. 70850, TS5-TS9 500/230kV Project). An application for right-of-way on the BLM portion of the project has been submitted and NEPA review is underway. A Draft Environmental Impact Statement was released on 11/9/12.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

To Be Determined

Line Designation	Avery loop-in of Pinnacle Peak-Raceway 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	3000 A
(c) Point of Origin	Pinnacle Peak-Raceway 230kV line; Sec. 8, T4N, R3E
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Avery substation; Sec. 15, T5N, R2E
(f) Length	Less than 1 mile
Routing	The Avery substation will be constructed adjacent to the Pinnacle Peak-Raceway 230kV line at approximately the Dove Valley Rd. and 39th Ave. alignments.
Purpose	This project is needed to provide electric energy in the northern portions of the Phoenix Metropolitan area as well as increase the reliability and continuity of service for these areas. The need date for this substation is continuously evaluated as the load growth in the area is monitored.
Date	
(a) Construction Start	To be determined
(b) Estimated In Service	To be determined
Permitting / Siting Status	*Certificate of Environmental Compatibility issued on 6/18/03 (Case No. 120, Decision No. 65997, North Valley Project). As described in the narrative section of this Ten-Year Plan, APS filed an Application pursuant to A.R.S. § 40-252 to extend the term of this CEC and amend it to conform with subsequent decisions and circumstances. An evidentiary hearing on APS's application is set for February 26, 2013.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

To Be Determined

Line Designation	Pinal Central – Sundance 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	ED-2
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	3000 A
(c) Point of Origin	Sundance substation; Sec. 2, T6S, R7E
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Pinal Central substation to be in-service by 2014; Sec. 30, T6S, R8E
(f) Length	Approximately 6 miles
Routing	The project will originate at a new substation on the Sundance property, proceeding west and then south along Curry Road to the half-section between State Route 287 and Earley Road. The final west to east alignment connecting into the Pinal Central Substation will be located within an ACC-approved corridor and is subject to further design and right-of-way acquisition analysis.
Purpose	This project will serve increasing loads in Pinal County, and throughout the APS system, and will improve reliability and continuity of service for the communities in the area. Also, the project will increase the reliability of Sundance by providing a transmission line in a separate corridor than the existing lines that exit the plant. The project will be constructed as a 230kV double-circuit capable line, but initially operated as a single-circuit. The in-service date for the second circuit will be evaluated in future planning studies.
Date	
(a) Construction Start	To be determined
(b) Estimated In Service	To be determined
Permitting / Siting Status	*Certificate of Environmental Compatibility issued 4/29/08 (Case No. 136, Decision No. 70325, Sundance to Pinal South 230kV Transmission Line project). Note – the Pinal South substation is now referred to as Pinal Central.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

To Be Determined

Line Designation	Jojoba loop-in of Liberty (TS4)-Panda 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	188 MVA
(c) Point of Origin	Liberty (TS4)-Panda 230kV line; Sec. 25, T2S, R4W
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Jojoba 230/69 substation with an in-service TBD; Sec. 25, T2S, R4W
(f) Length	Less than 1 mile
Routing	The Jojoba 230/69kV substation will be constructed adjacent to the Liberty (TS4)-Panda 230kV line.
Purpose	This project will provide the electrical source and support to the sub-transmission system to serve the need for electric energy for the communities including Buckeye, Goodyear, and Gila Bend. The project will also increase the reliability and continuity of service for those areas.
Date	
(a) Construction Start	To be determined
(b) Estimated In Service	To be determined
Permitting / Siting Status	*Certificate of Environmental Compatibility issued 10/16/00 (Case No. 102, Decision No. 62960, Gila River Transmission Project) for the Gila River Transmission Project which included the interconnection of the 230kV substation.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

To Be Determined

Line Designation	TS8 – Yucca 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	To be determined
(c) Point of Origin	Yucca substation; Sec. 36, T7S, R24W
(d) Intermediate Points of Interconnection	
(e) Point of Termination	TS8 230kV substation to be in-service by 2016; Sec. 20, T9S, R22W
(f) Length	Approximately 19 miles
Routing	The line will proceed west from the TS8 substation along County 14th Street to the A Canal. Then the route will proceed southwest along the A Canal to Avenue 4E, where it will continue west along County 14 ½ Street to US 95. The line will proceed north along US 95 to the County 13 ½ Street alignment and proceed west along County 13 ½ and County 13th Street. At Avenue F the line will proceed north to Levee Road, where it will proceed north east until the 8th Street alignment. The line will proceed east along 8th Street until Calle Agua Salada Road, where it will proceed north to the Yucca Power Plant.
Purpose	This double circuit 230kV project will serve the need for electric energy, improve reliability, and continuity of service for the greater Yuma area. Additionally, this project will provide a second electrical source to the future TS8 substation. The ability to transmit electric energy generated by renewable resources in the region may be an additional benefit subject to study by APS in regional planning forums.
Date	
(a) Construction Start	To be determined
(b) Estimated In Service	To be determined
Permitting / Siting Status	*Certificate of Environmental Compatibility issued 2/2/12 (Case No. 163, Decision No. 72801, North Gila to TS8 to Yucca 230kV Transmission Line project).*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

To Be Determined

Line Designation	Sun Valley – TS10 –TS11 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	To be determined
(c) Point of Origin	Sun Valley substation to be in-service by 2016; Sec. 29, T4N, R4W
(d) Intermediate Points of Interconnection	A future TS10 substation; location to be determined
(e) Point of Termination	A future TS11 substation; location to be determined
(f) Length	To be determined
Routing	The routing for this line has not yet been determined.
Purpose	This project is needed to provide a transmission source to serve future load that emerges in the currently undeveloped areas northwest of the White Tank Mountains. This line is anticipated to be a 230kV line originating from the Sun Valley substation, with the future TS10 230/69kV substation to be interconnected into the 230kV line.
Date	
(a) Construction Start	To be determined
(b) Estimated In Service	To be determined
Permitting / Siting Status	*An application for a Certificate of Environmental Compatibility has not yet been filed.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

To Be Determined

Line Designation	Buckeye – TS11 – Sun Valley 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	To be determined
(c) Point of Origin	Sun Valley substation to be in-service by 2016; Sec. 29, T4N, R4W
(d) Intermediate Points of Interconnection	A future TS11 substation; location to be determined
(e) Point of Termination	Buckeye substation; Sec. 7, T1N, R3W
(f) Length	To be determined
Routing	The routing for this line has not yet been determined.
Purpose	This project will serve the need for electric energy in the largely undeveloped areas west of the White Tank Mountains. This project will provide the first portion of the transmission infrastructure in this largely undeveloped area and will provide a transmission connection between the northern and southern transmission sources that will serve the area. Improved reliability and continuity of service will result for this portion of Maricopa County. It is anticipated that this project will be constructed with double-circuit capability, but initially operated as a single circuit. The in-service date and location of the TS11 230/69kV substation will be determined in future planning studies based upon the development of the area.
Date	
(a) Construction Start	To be determined
(b) Estimated In Service	To be determined
Permitting / Siting Status	*An application for a Certificate of Environmental Compatibility has not yet been filed.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

To Be Determined

Line Designation	Raceway – Westwing 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	To be determined
(c) Point of Origin	Westwing substation; Sec. 12, T4N, R1W
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Raceway substation; Sec. 4, T5N, R1E
(f) Length	Approximately 7 miles
Routing	Northeast from Westwing substation paralleling existing transmission lines to the Raceway 230kV substation.
Purpose	This project was originally anticipated to serve the need for electric energy in the far north and northwest parts of the Phoenix Metropolitan area and provide contingency support for multiple Westwing 500/230kV transformer outages. APS has determined that this line is no longer needed and has applied to modify its CEC to cancel this portion of the line.
Date	
(a) Construction Start	To be determined
(b) Estimated In Service	To be determined
Permitting / Siting Status	*Certificate of Environmental Compatibility issued 6/18/03 (Case No. 120, Decision No. 65997, North Valley 230kV Transmission Line Project). As described in the narrative section of this Ten-Year Plan, APS filed an Application pursuant to A.R.S. § 40-252 to extend the term of this CEC and amend it to conform with subsequent decisions and circumstances. An evidentiary hearing on APS's application is set for February 26, 2013.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

To Be Determined

Line Designation	El Sol – Westwing 230kV Line
Project Sponsor	Arizona Public Service Company
Other Participants	None
Size	
(a) Voltage Class	230kV AC
(b) Facility Rating	To be determined
(c) Point of Origin	Westwing substation; Sec. 12, T4N, R1W
(d) Intermediate Points of Interconnection	
(e) Point of Termination	El Sol substation; Sec. 30, T3N, R1E
(f) Length	Approximately 11 miles
Routing	Generally following the existing Westwing-Surprise-El Sol 230kV corridor.
Purpose	This project will increase system capacity to serve the Phoenix Metropolitan area, while maintaining system reliability and integrity for delivery of bulk power from Westwing south into the APS Phoenix Metropolitan area 230kV transmission system.
Date	
(a) Construction Start	To be determined
(b) Estimated In Service	To be determined
Permitting / Siting Status	*Certificate of Environmental Compatibility issued 7/26/73 (Case No. 9, Docket No. U-1345). Note that this Certificate authorizes two double-circuit lines. Construction of the first double-circuit line was completed in March 1975. Construction of the second line, planned to be built with double-circuit capability, but initially operated with a single circuit, is described above.*

Arizona Public Service Company
2013 – 2022
Ten-Year Plan
Planned Transmission Description

To Be Determined

Line Designation	Palo Verde – Saguaro 500kV Line
Project Sponsor	CATS Sub-Regional Planning Group Participants
Other Participants	To be determined
Size	
(a) Voltage Class	500kV AC
(b) Facility Rating	To be determined
(c) Point of Origin	Palo Verde switchyard; Sec. 34, T1N, R6W
(d) Intermediate Points of Interconnection	
(e) Point of Termination	Saguaro substation; Sec. 14, T10S, R10E
(f) Length	Approximately 130 miles
Routing	Generally south and east from the Palo Verde area to a point near Gillespie Dam, then generally easterly until the point at which the Palo Verde-Kyrene 500kV line diverges to the north and east. The corridor then continues generally south and east again, adjacent to a gas line corridor, until converging with the Tucson Electric Power Company's Westwing-South 345kV line. The corridor follows the 345kV line until a point due west of the Saguaro Generating Station. The corridor then follows a lower voltage line into the 500kV yard just south and east of the Saguaro Generating Station.
Purpose	The line will increase the adequacy of the existing EHV transmission system and increase power delivery throughout the state.
Date	
(a) Construction Start	To be determined
(b) Estimated In Service	To be determined
Permitting / Siting Status	*Certificate of Environmental Compatibility issued 1/23/1976 (Case No. 24, Decision No. 46802).*

A subsidiary of Pinnacle West Capital Corporation

TRANSMISSION PLANNING PROCESS AND GUIDELINES

APS Transmission Planning

January 2013

TRANSMISSION PLANNING PROCESS AND GUIDELINES

III. PLANNING ASSUMPTIONS

I. INTRODUCTION AND PURPOSE

The Transmission Planning Process and Guidelines (Guidelines) are used by Arizona Public Service Company (APS) to assist in planning its Extra High Voltage (EHV) transmission system (345kV and 500kV) and High Voltage transmission system (230kV and 115kV). In addition to these Guidelines, APS follows the Western Electricity Coordinating Council's (WECC) regional planning reliability criteria for system disturbance and performance levels. These WECC Reliability Criteria are (1) WECC/NERC Reliability Criteria for Transmission System Planning and (2) Minimum Operating Reliability Criteria, which can be found in their entirety on the WECC website; (http://www.wecc.biz/documents/library/procedures/CriteriaMaster.pdf). These Guidelines are for internal use by APS and may be changed or modified. Thus, others should not use these Guidelines without consultation with APS.

II. PLANNING METHODOLOGY

A. General

APS uses a deterministic approach for transmission system planning. Under this approach, system performance should meet certain specific criteria under normal conditions (all lines in-service) and for any single contingency condition (any one element out-of-service). In general, an adequately planned transmission system will:

- Provide an acceptable level of service that is cost-effective for normal and single contingency operating conditions.
- Maintain service to all firm loads for any single contingency outage; except for radial loads.
- Not result in overloaded equipment or unacceptable voltage conditions for single contingency outages.
- Not result in cascading for single or double contingency outages.
- Provide for the proper balance between the transmission import capability and local generation requirements for an import limited load area.

Although APS uses a deterministic approach for transmission system planning, the WECC reliability planning criteria provides for exceptions based upon a probabilistic approach. APS uses these probabilistic criteria when/where appropriate in the transmission planning process. Historical system reliability performance is analyzed on a periodic basis and the results are used in the design of planned facilities.

These planning methodologies, assumptions, and guidelines are used as the basis for the development of future transmission facilities. Additionally, consideration of potential alternatives to transmission facilities (such as distributed generation or new technologies) is evaluated on a case-specific basis.

As new planning tools and/or information become available revisions or additions to these guidelines will be made as appropriate.

B. Transmission Planning Process

APS's transmission planning process consists of an assessment of the following needs:

- Provide adequate transmission to access designated network resources in-order to reliably and economically serve all network loads.
- Support APS's and other network customers' local transmission and sub-transmission systems.
- Provide for interconnection for new resources.
- Accommodate requests for long-term transmission access.

During this process, consideration is given to load growth patterns, other system changes affected by right-of-way, facilities siting constraints, routing of future transportation corridors, and joint planning with neighboring utilities, governmental entities, and other interested stakeholders (see APS OATT Attachment (E)).

1. EHV Transmission Planning Process

APS's EHV transmission system, which consists of 500kV and 345kV, has primarily been developed to provide transmission to bring the output of large base-loaded generators to load centers, such as Phoenix. Need for new

EHV facilities may result from any of the bullet items described above. APS's annual planning process includes an assessment of APS's transmission capability to ensure that designated network resources can be accessed to reliably and economically serve all network loads. In addition, biennial Reliability Must-Run (RMR) studies are performed to ensure that proper balance between the transmission import capability and local generation requirements for an import limited load area are maintained.

2. 230kV Transmission Planning Process

APS's 230kV transmission system has primarily been developed to provide transmission to distribute power from the EHV bulk power substations and local generators to the distribution system and loads throughout the load areas.

Planning for the 230kV system assesses the need for new 230/69kV substations to support local sub-transmission and distribution system growth and the reliability performance of the existing 230kV system. This process takes into account the future land use plans that were developed by government agencies, Landis aerial photo maps, master plans that were provided by private developers, and APS's long-range forecasted load densities per square mile for residential, commercial, and industrial loads.

3. Transmission Facilities Required for Generation/Resource Additions

New transmission facilities may also be required in conjunction with generation resources due to (1) a "merchant" request by an Independent Power Producer (IPP) for generator interconnection to the APS system, (2) a "merchant" request for point-to-point transmission service from the generator (receipt point) to the designated delivery point, or (3) designation of new resources or re-designation of existing units to serve APS network load (including removal of an older units' native load designation). These studies/processes are performed pursuant to the APS Open Access Transmission Tariff (OATT).

C. Ten Year Transmission System Plans

Each year APS uses the planning process described in section B to update the Ten-Year Transmission System Plan. The APS Ten Year Transmission System Plan identifies all new transmission facilities, 115kV and above, and all facility replacements/upgrades required over the next ten years to reliably and economically serve the load.

D. Regional Coordinated Planning

1. Western Electricity Coordinating Council (WECC)

APS is a member of the WECC. The focus of the WECC is promoting the reliability of the interconnected bulk electric system. The WECC provides the means for:

- Developing regional planning and operating criteria.
- Coordinating future plans.
- Compiling regional data banks for use by the member systems and the WECC in conducting technical studies.
- Assessing and coordinating operating procedures and solutions to regional problems.
- Establishing an open forum with interested non-project participants to review the plan of service for a project.
- Through the WECC Transmission Expansion Policy Committee, performing economic transmission congestion analysis.

APS works with WECC to adhere to these planning practices.

2. Sub-Regional Planning Groups

Southwest Area Transmission Planning (SWAT) and other sub-regional planning groups provide a forum for entities within a region, and any other interested parties, to determine and study the needs of the region as a whole. It also provides a forum for specific projects to be exposed to potential partners and allows for joint studies and participation from interested parties.

3. WestConnect

APS and the other WestConnect members executed the WestConnect Project Agreement for Subregional Transmission Planning in May of 2007. This agreement promotes coordination of regional transmission planning for the WestConnect planning area by formalizing a relationship among the WestConnect members and the WestConnect area sub-regional planning groups including SWAT. The agreement provides for resources and funding for the development of a ten year integrated regional transmission plan for the WestConnect planning area. The agreement also ensures that the WestConnect transmission planning process will be coordinated and integrated with other planning processes within the Western Interconnection and with the WECC planning process.

4. Joint Studies

In many instances, transmission projects can serve the needs of several utilities and/or IPPs. To this end, joint study efforts may be undertaken. Such joint study efforts endeavor to develop a plan that will meet the needs and desires of all individual companies involved.

E. Generation Schedules

For planning purposes, economic dispatches of network resources are determined for APS's system peak load in the following manner:

a. Determine base generation available and schedule these units at maximum output.
b. Determine resources purchased from other utilities, IPPs, or power marketing agencies.
c. Determine APS's spinning reserve requirements.
d. Schedule intermediate generation (oil/gas steam units) such that the spinning reserve requirements, in section (c) above, are met.
e. Determine the amount of peaking generation (combustion turbine units) required to supply the remaining system peak load.

Phoenix area network resources are dispatched based on economics and any existing import limitations. When possible, spinning reserve will be carried on higher cost Phoenix area network generating units.

Generation output schedules for interconnected utilities and IPPs are based upon consultation with the neighboring utilities and IPPs or as modeled in the latest data in WECC coordinated study cases.

F. Load Projections

APS substation load projections are based on the APS Corporate Load Forecast. Substation load projections for neighboring interconnected utilities or power agencies operating in the WECC area are based on the latest data in WECC coordinated study cases. Heavy summer loads are used for the Ten-Year Transmission System Plans.

G. Alternative Evaluations

1. General

In evaluating several alternative plans, comparisons of power flows, transient stability tests, and fault levels are made first. After the alternatives are found that meet the system performance criteria in each of these three areas comparisons may be made of the losses, transfer capability, impact on system operations, and reliability of each of the plans. Finally, the costs of facility additions (capital cost items), costs of losses, and relative costs of transfer capabilities are determined. A brief discussion of each of these considerations follows.

2. Power Flow Analyses

Power flows of base case (all lines in-service) and single contingency conditions are tested and should conform to the system performance criteria set forth in Section IV of these Guidelines. Double or multiple contingencies are examined, but in general, no facilities are planned for such conditions. Normal system voltages, voltage deviations, and voltage extreme limitations are based upon operating experience resulting in acceptable voltage levels to

the consumer. Power flow limits are based upon the thermal ratings and/or sag limitations of conductors or equipment, as applicable.

3. Transient Stability Studies

   Stability guidelines are established to maintain system stability for single contingency, three-phase fault conditions. Double or multiple contingencies are examined, but in general, no facilities are planned for such conditions.

4. Short Circuit Studies

   Three-phase and single-phase-to-ground fault studies are performed to ensure the adequacy of system protection equipment to clear and isolate faults.

5. Reactive Power Margin Analyses

   Reactive Power Margin analyses are performed when steady-state analyses indicate possible insufficient voltage stability margins. V-Q curve analyses are used to determine post-transient voltage stability.

6. Losses Analyses

   A comparison of individual element and overall transmission system losses are made for each alternative plan being studied. The losses computed in the power flow program consist of the I^2R losses of lines and transformers and the core losses in transformers, where represented.

7. Transfer Capability Studies

   In evaluating the relative merits of one or more EHV transmission plans, both simultaneous and non-simultaneous transfer capability studies are performed to determine the magnitude of transfer capabilities between areas or load centers.

8. Subsynchronous Resonance (SSR)

   SSR phenomenon result from the use of series capacitors in the network where the tuned electrical network exchanges energy with a turbine generator at one or more of the natural frequencies of the mechanical system. SSR countermeasures are applied to prevent damage to machines as a result of transient current or sustained oscillations following a system disturbance. SSR studies are not used directly in the planning process. SSR countermeasures are determined after the transmission plans are finalized.

9. FACTS (Flexible AC Transmission System)

FACTS devices are a recent application of Power Electronics to the transmission system. These devices make it possible to use circuit reactance, voltage magnitude and phase angle as control parameters to redistribute power flows and regulate bus voltages, thereby improving power system operation. FACTS devices can provide series or shunt compensation. These devices can be used as a controllable voltage source in series or as a controllable current source in shunt mode to improve the power transmission system operations. FACTS will be evaluated as a means of power flow control and/or to provide damping to dynamic oscillations where a need is identified and it is economically justified.

10. Economic Evaluation

In general, an economic evaluation of alternative plans consists of a cumulative present worth or equivalent annual cost comparison of capital costs.

III. PLANNING ASSUMPTIONS

A. General

1. Loads

Loads used for the APS system originate from the latest APS Corporate Load Forecast. In most cases, the corrected power factor of APS loads is 99.5% at 69kV substations.

2. Generation and Other Resources

Generation dispatch is based on firm power and/or transmission wheeling contracts including network resources designations.

3. Normal Voltage Levels

a. Nominal EHV design voltages are 500kV, 345kV, 230kV, and 115kV.

b. Nominal EHV operating voltages are 535kV, 348kV, 239kV, and 119kV.

4. Sources of Databases

WECC Heavy Summer base cases are the sources of the databases. Loop flow (unscheduled flow), of a reasonable amount and direction, will be allowed for use in planning studies.

5. Voltage Control Devices

Devices which can control voltages are shunt capacitors, shunt reactors, tap-changing-under-load (TCUL) and fixed-tap transformers, static Volt Ampere Reactive (VAR) compensators, and machine VAR capabilities. If future voltage control devices are necessary, these devices will be evaluated based upon economics and the equipment's ability to obtain an adequate voltage profile on the EHV and HV systems.

6. Phase Shifters

In general, where phase shifters are used, schedules are held across the phase shifter in base case power flows and the phase shifter tap remains fixed in the outage cases.

7. Conductor Sizes

Existing transmission voltages utilized by APS are 230kV, 345kV, and 500kV. It is presently planned that the 345kV transmission system will not be expanded, thus all future APS EHV lines will be 500kV or 230kV. Planned 500kV lines will initially be modeled using tri-bundled 1780 kCM ACSR conductor (Chukar). Preferred construction for 230kV lines consists of 2156 kCM ACSS conductor on steel poles.

8. 69kV System Modeling

230kV facility outages may result in problems to the underlying 69kV system due to the interconnection of those systems. For this reason, power flow cases include a detailed 69kV system representation. Solutions to any problems encountered on the 69kV system are coordinated with the subtransmission planning engineers.

9. Substation Transformers

a. 500kV and 345kV Substations

Bulk substation transformer banks may be made up of one three-phase or three single-phase transformers, depending upon bank size and economics. For larger banks where single-phase transformers are used, a fourth (spare) single-phase transformer will be used in a jack-bus arrangement to improve reliability and facilitate connection of the spare in the event of an outage of one of the single-phase transformers. TCUL will be considered in the high voltage windings, generally with a range of plus or minus 10%. High voltage ratings will be 500kV or 345kV class and low voltage windings will be 230kV, 115kV, or 69kV class.

b. 230kV Substations

For high-density load areas, both 230/69kV and 69/12.5kV transformers can be utilized. 230/69kV transformers will be rated at 113/150/188 MVA with a 65°C temperature rise, unless otherwise specified. 69/12.5kV transformers will be rated at 25/33/41 MVA with a 65°C temperature rise, unless otherwise specified.

With all elements in service, a transformer may be loaded up to its top Forced Oil Air (FOA) rating without sustaining any loss of service life. For a single contingency outage (loss of one transformer) the remaining transformer or transformers may be loaded up to 20% above their top FOA rating, unless heat test data indicate a different overload capability. The loss of service life sustained will depend on the transformer pre-loading and the outage duration. Tap setting adjustment capabilities on 230/69kV transformers will be ±5% from the nominal voltage setting (230/69kV) at 2½% increments.

10. Switchyard Arrangements

a. 500kV and 345kV Substations

Existing 345kV switchyard arrangements use breaker-and-one-half, main-and-transfer, or modified paired-element circuit breaker switching

schemes. Because of the large amounts of power transferred via 500kV switchyards and the necessity of having adequate reliability, all 500kV circuit breaker arrangements are planned for an ultimate breaker-and-one-half scheme. If only three or four elements are initially required, the circuit breakers are connected in a ring bus arrangement, but physically positioned for a breaker-and-one-half scheme. The maximum desired number of elements to be connected in the ring bus arrangement is four. System elements such as generators, transformers, and lines will be arranged in breaker-and-one-half schemes such that a failure of a center breaker will not result in the loss of two lines routed in the same general direction and will minimize the impact of losing two elements.

b. 230kV Substations

Future 230/69kV substations should be capable of serving up to 452 Megavolt-Amps (MVA) of load. 400 MVA has historically been the most common substation load level in the Phoenix Metropolitan area. Future, typical 230/69kV substations should accommodate up to four 230kV line terminations and up to three 230/69kV transformer bays. Based upon costs, as well as reliability and operating flexibility considerations, a breaker-and-one-half layout should be utilized for all future 230/69kV Metropolitan Phoenix Area substations, with provision for initial development to be a ring bus. Any two 230/69kV transformers are to be separated by two breakers, whenever feasible, so that a stuck breaker will not result in an outage of both transformers.

11. Series Capacitor Application

Series capacitors may be used on EHV lines to increase system stability, for increased transfer capability, and/or for control of power flow. The series capacitors may be lumped at one end of a line because of lower cost; however, the capacitors are generally divided into two banks, one at either end of a line, for improved voltage profile.

12. Shunt and Tertiary Reactor Application

Shunt and/or tertiary reactors may be installed to prevent open end line voltages from being excessive, in addition to voltage control. The open end line voltage must not be more than 0.05 per unit voltage greater than the sending end voltage. Tertiary reactors may also be used for voltage and VAR control as discussed above.

B. Power Flow Studies

1. System Stressing

Realistic generation capabilities and schedules should be used to stress the transmission system in order to maximize the transfer of resources during the maximum load condition.

2. Displacement

In cases where displacements (due to power flow opposite normal generation schedules) may have an appreciable effect on transmission line loading, a reasonable amount of displacement (Generation Units) may be removed in-order to stress a given transmission path.

C. Transient Stability Studies

1. Fault Simulation

When studying system disturbances caused by faults, two conditions will be simulated:

a. Three-phase-to-ground faults, and
b. Single-line-to-ground faults with a stuck circuit breaker in one phase with back-up delayed clearing.

2. Margin

a. Generation margin may be applied for the contingencies primarily affected by generation, or
b. Power flow margin may be applied for the contingencies primarily affected by power flow.

3. Unit Tripping

   Generator unit tripping may be allowed in-order to increase system stability performance.

4. Machine Reactance Representation

   For transient stability studies, the unsaturated transient reactance of machines with full representation will be used.

5. Fault Damping

   Fault damping will be applied to the generating units adjacent to faults. Fault damping will be determined from studies that account for the effect of generator amortisseur windings and the SSR filters.

6. Series Capacitor Switching

   Series capacitors, locations to be determined from short circuit studies, will be flashed and reinserted as appropriate.

D. Short Circuit Studies

Three-phase and single-phase-to-ground faults will be evaluated.

1. Generation Representation

   All generation will be represented.

2. Machine Reactance Representation

   The saturated subtransient reactance ($X"_d$) values will be used.

3. Line Representation

   The transmission line zero sequence impedance (X_0) is assumed to be equal to three times the positive sequence impedance (X_1).

4. Transformer Representation

   The transformer zero sequence impedance (X_0) is assumed to be equal to the positive sequence impedance (X_1). Bulk substation transformers are modeled as auto-transformers. The two-winding model is that of a grounded-wye transformer. The three-winding model is that of a wye-delta-wye with a solid ground.

E. Reactive Power Margin Studies

Using Q-V curve analyses, APS assesses the interconnected transmission system to ensure there are sufficient reactive resources located throughout the electric system to maintain post-transient voltage stability for system normal conditions and certain contingencies.

IV. SYSTEM PERFORMANCE

A. Power Flow Studies

1. Normal (Base Case Conditions)

a. Voltage Levels

1) General

(a) 500kV bus voltages will be maintained between 1.05 and 1.08 p.u. on a 500kV base.

(b) 345kV bus voltages will range between .99 and 1.04 p.u. on the 345kV system.

(c) 500kV and 345kV system voltages are used to maintain proper 230kV bus voltages.

(d) Voltage on the 230kV and 115kV system should be between 1.01 p.u. and 1.05 p.u.

(e) Tap settings for 230/69kV and 345/69kV transformers should be used to maintain low side (69kV) voltages of 1.03 to 1.04 p.u. Seasonal tap changes may be required.

2) Specific Buses

(a) APS Pinnacle Peak 230kV bus voltage should be between 1.025 p.u. and 1.035 p.u.

(b) APS Westwing 230kV bus voltage should be between 1.04 p.u. and 1.05 p.u.

(c) Saguaro 115kV bus voltage will be approximately 1.035 p.u.

(d) Voltage at the Prescott (DOE) 230kV bus should be approximately 1.02 p.u.

b. Facility Loading Limits

1) Transmission Lines

Transmission line loading cannot exceed 100% of the continuous rating, which is based upon established conductor temperature limit or sag limitation.

2) Underground Cable

Underground cable loading should not exceed 100% of the continuous rating with all elements in service. This rating is based on a cable temperature of 85°C with no loss of cable life.

3) Transformers

Transformers cannot exceed 100% of top FOA, 65°C rise, nameplate ratings.

4) Series Capacitors

Series Capacitors cannot exceed 100% of continuous rating.

c. Interchange of VARs

Interchange of VARs between companies at interconnections will be reduced to a minimum and maintained near zero.

d. Distribution of Flow

Schedules on a new project will be compared to simulated power flows to ensure a reasonable level of flowability.

2. Single Contingency Outages

a. Voltage Levels

Maximum voltage deviation on APS's major buses cannot exceed 5%. This deviation level yields a close approximation to the post-transient VAR margin requirements of WECC.

b. Facilities Loading Limits

1) Transmission Lines

Transmission line loading cannot exceed 100% of the lesser of the sag limit or the emergency rating (30-minute rating) which is based upon established conductor temperature limits.

2) Underground Cable

Underground cable loading should not exceed the emergency rating during a single-contingency outage. This rating is based on a cable temperature of 105°C for two hours of emergency operation with no loss of cable life.

3) Transformers

Transformers cannot exceed 120% of top FOA, 65°C rise, nameplate ratings.

4) Series Capacitors

Series Capacitors cannot exceed 100% of emergency rating.

c. Generator Units

Generator units used for controlling remote voltages will be modified to hold their base case terminal voltages.

d. Impact on Interconnected System

Single contingency outages will not cause overloads upon any neighboring transmission system.

B. Transient Stability Studies

Transient stability studies are primarily performed on the 500kV and 345kV systems.

1. Fault Simulation

Three-phase-to-ground faults and single-line-to-ground faults, simulating a stuck circuit breaker in one phase with back-up delayed clearing will be simulated. Fault clearing times of four cycles after fault inception (5 cycles for a 230kV fault) and a back-up clearing time of twelve cycles after fault inception is utilized. System elements are switched out at the appropriate clearing times, as applicable. Fault damping will be applied when applicable at fault inception.

2. Series Capacitor Switching

Series capacitors, at locations determined from short-circuit studies, will be flashed at fault inception and will be reinserted depending on their reinsertion types.

3. System Stability

The system will be considered stable if the following conditions are met:

a. All machines in the system remain synchronized as demonstrated by the relative rotor angles.

b. Positive system damping exists as demonstrated by the damping of relative rotor angles and the damping of voltage magnitude swings. For N-1 disturbances, voltages for the first swing after fault clearing should not drop below 75% of pre-fault value with maximum time duration of 20 cycles for voltage dip exceeding 20%.

4. Re-closing

Automatic re-closing of circuit breakers controlling EHV facilities is not utilized.

C. Short Circuit Studies

Fault current shall not exceed 100% of the applicable breaker fault current interruption capability for three-phase or single-line-to-ground faults.

D. Reactive Power Margin Studies

For system normal conditions or single contingency conditions, post-transient voltage stability is required with a path or load area modeled at a minimum of 105% of the path rating or maximum planned load limit for the area under study, whichever is applicable. For multiple contingencies, post-transient voltage stability is required with a path or load area modeled at a minimum of 102.5% of the path rating or maximum planned load limit for the area under study, whichever is applicable.

2012 SYSTEM RATING MAPS

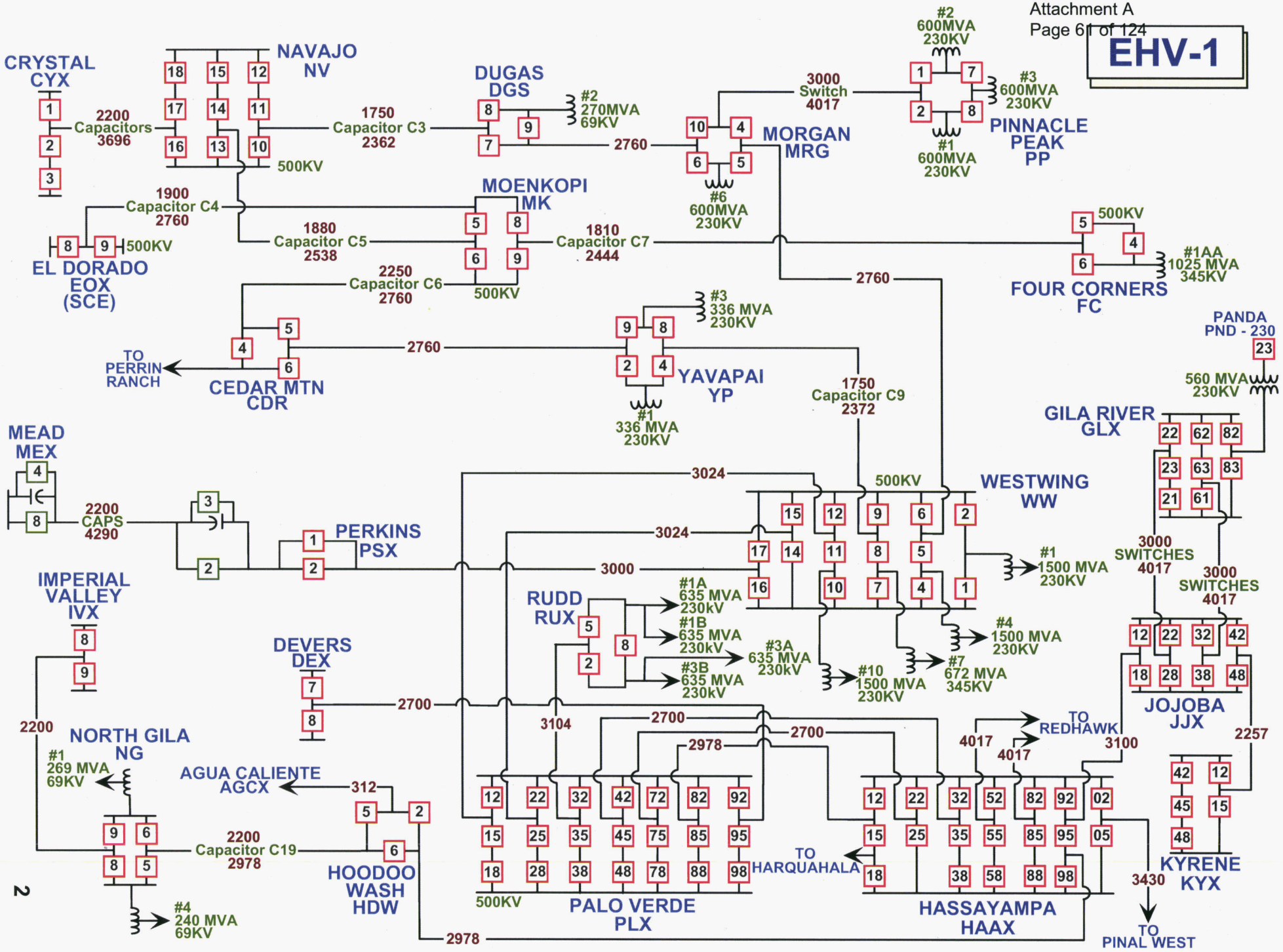
Aug 2012

TABLE OF CONTENTS

LEGEND
SYSTEM RATING MAPS

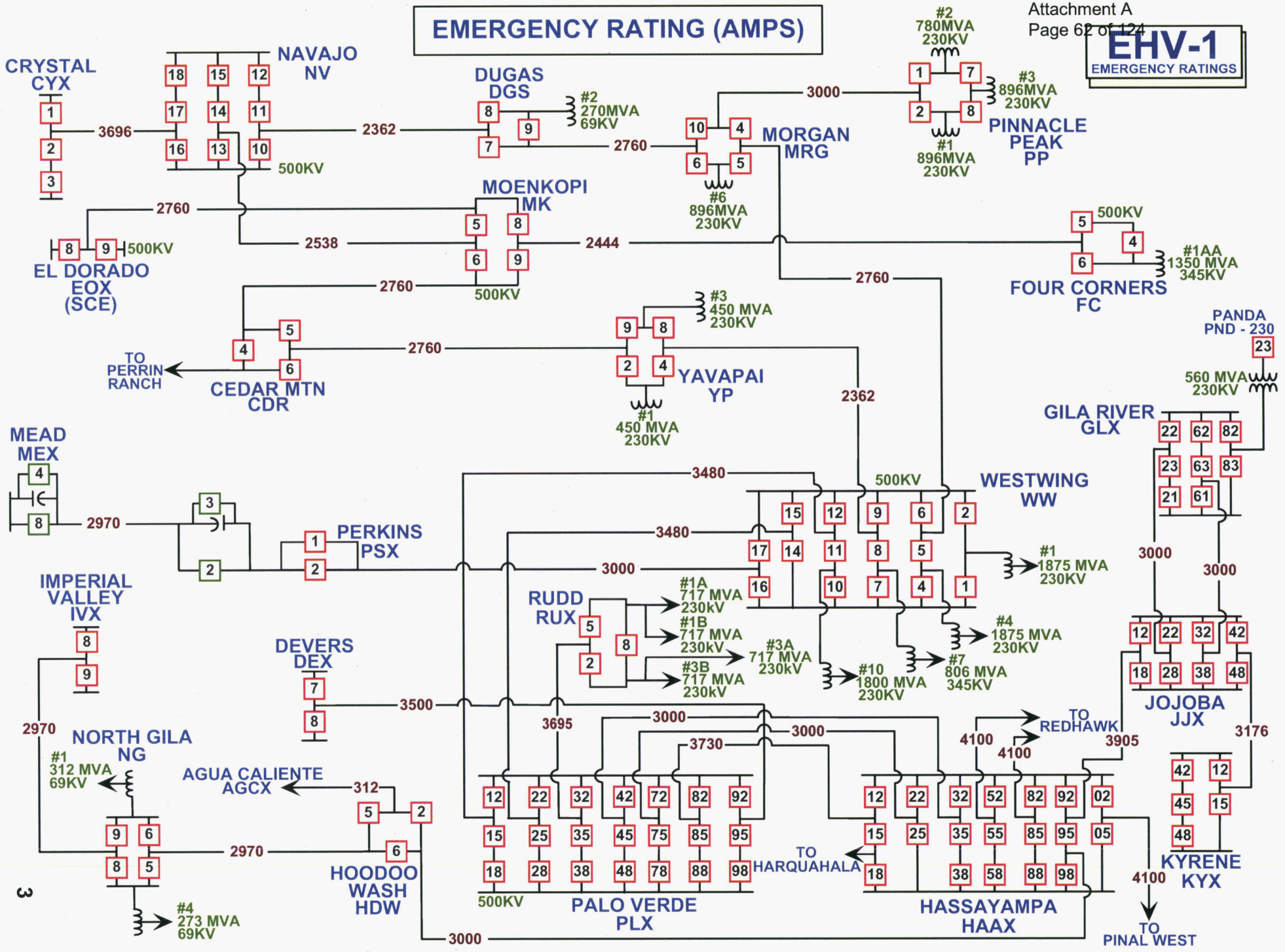
SYMBOL	DESCRIPTION
###	CURRENT LIMIT IN AMPS
—###—	LIMITING ELEMENT
###	CONDUCTOR LIMIT IN AMPS
	TRANSFORMER LIMITS ARE IN MVA
———	OVERHEAD TRANSMISSION LINE
- - - - - -	UNDERGROUND CABLE
M	MOTOR OPERATED SWITCH
V	VACCUM SWITCH
H	HYDRAULIC SWITCH
1	BREAKER NUMBER

EHV-1

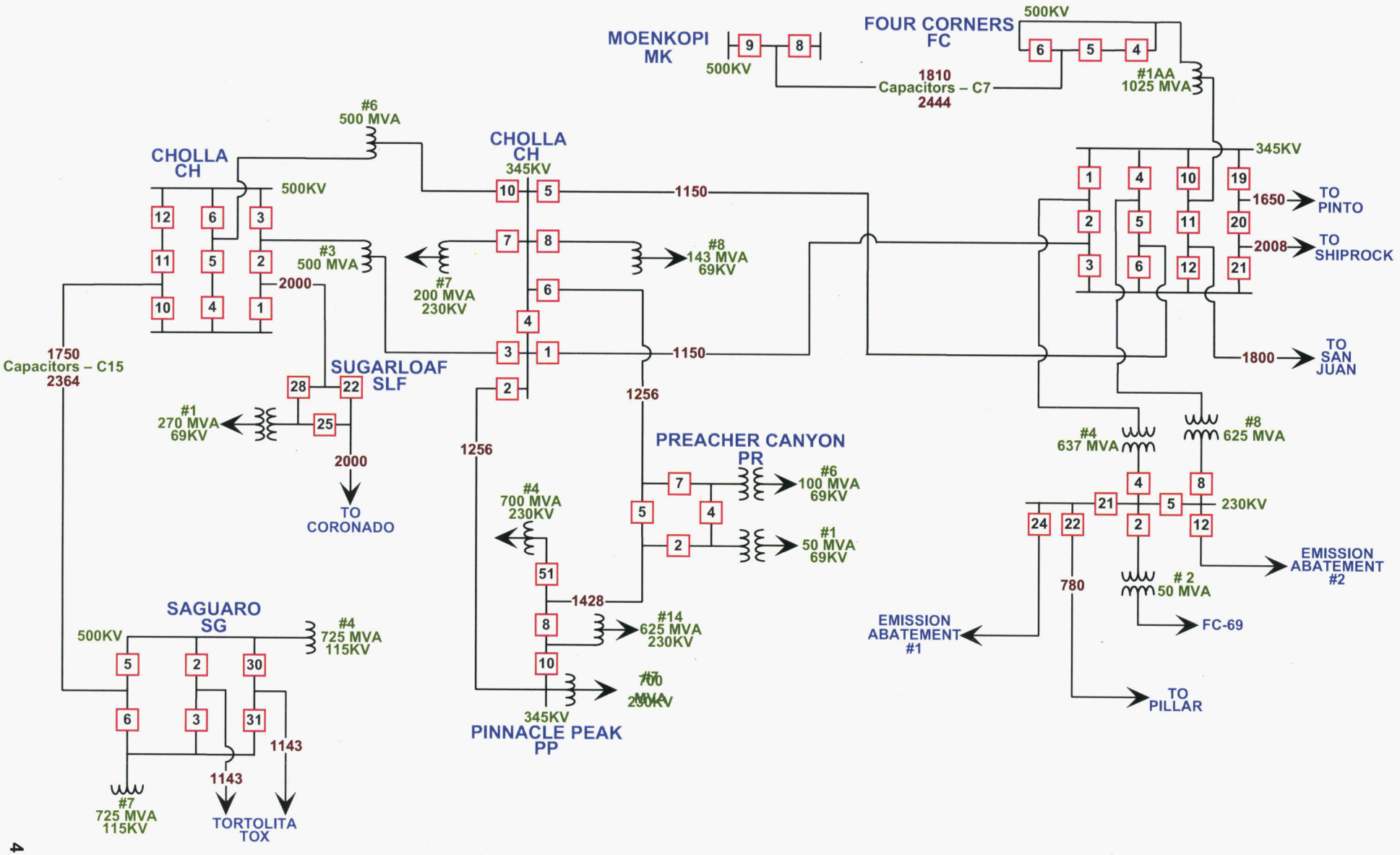

CRYSTAL
CYX
NAVAJO
NV
2200
Capacitors
3696
500KV
1750
Capacitor C3
2362
DUGAS
DGS
#2
270MVA
69KV
2760
3000
Switch
4017
#2
600MVA
230KV
#3
600MVA
230KV
#1
600MVA
230KV
PINNACLE
PEAK
PP
MORGAN
MRG
#6
600MVA
230KV
1900
Capacitor C4
2760
MOENKOPI
MK
1880
Capacitor C5
2538
1810
Capacitor C7
2444
500KV
EL DORADO
EOX
(SCE)
500KV
#1AA
1025 MVA
345KV
FOUR CORNERS
FC
2250
Capacitor C6
2760
500KV
2760
#3
336 MVA
230KV
TO
PERRIN
RANCH
CEDAR MTN
CDR
2760
YAVAPAI
YP
#1
336 MVA
230KV
1750
Capacitor C9
2372
PANDA
PND - 230
560 MVA
230KV
GILA RIVER
GLX
MEAD
MEX
2200
CAPS
4290
PERKINS
PSX
3024
3024
3000
500KV
WESTWING
WW
#1
1500 MVA
230KV
3000
SWITCHES
4017
3000
SWITCHES
4017
IMPERIAL
VALLEY
IVX
RUDD
RUX
#1A
635 MVA
230kV
#1B
635 MVA
230kV
#3A
635 MVA
230kV
#3B
635 MVA
230kV
#4
1500 MVA
230KV
#10
1500 MVA
230KV
#7
672 MVA
345KV
DEVERS
DEX
2700
3104
2700
2700
2978
TO
REDHAWK
4017
4017
3100
JOJOBA
JJX
2257
2200
NORTH GILA
NG
#1
269 MVA
69KV
AGUA CALIENTE
AGCX
312
2200
Capacitor C19
2978
HOODOO
WASH
HDW
#4
240 MVA
69KV
500KV
PALO VERDE
PLX
TO
HARQUAHALA
HASSAYAMPA
HAAX
3430
TO
PINAL WEST
KYRENE
KYX
2978

EMERGENCY RATING (AMPS)

EHV-1
EMERGENCY RATINGS

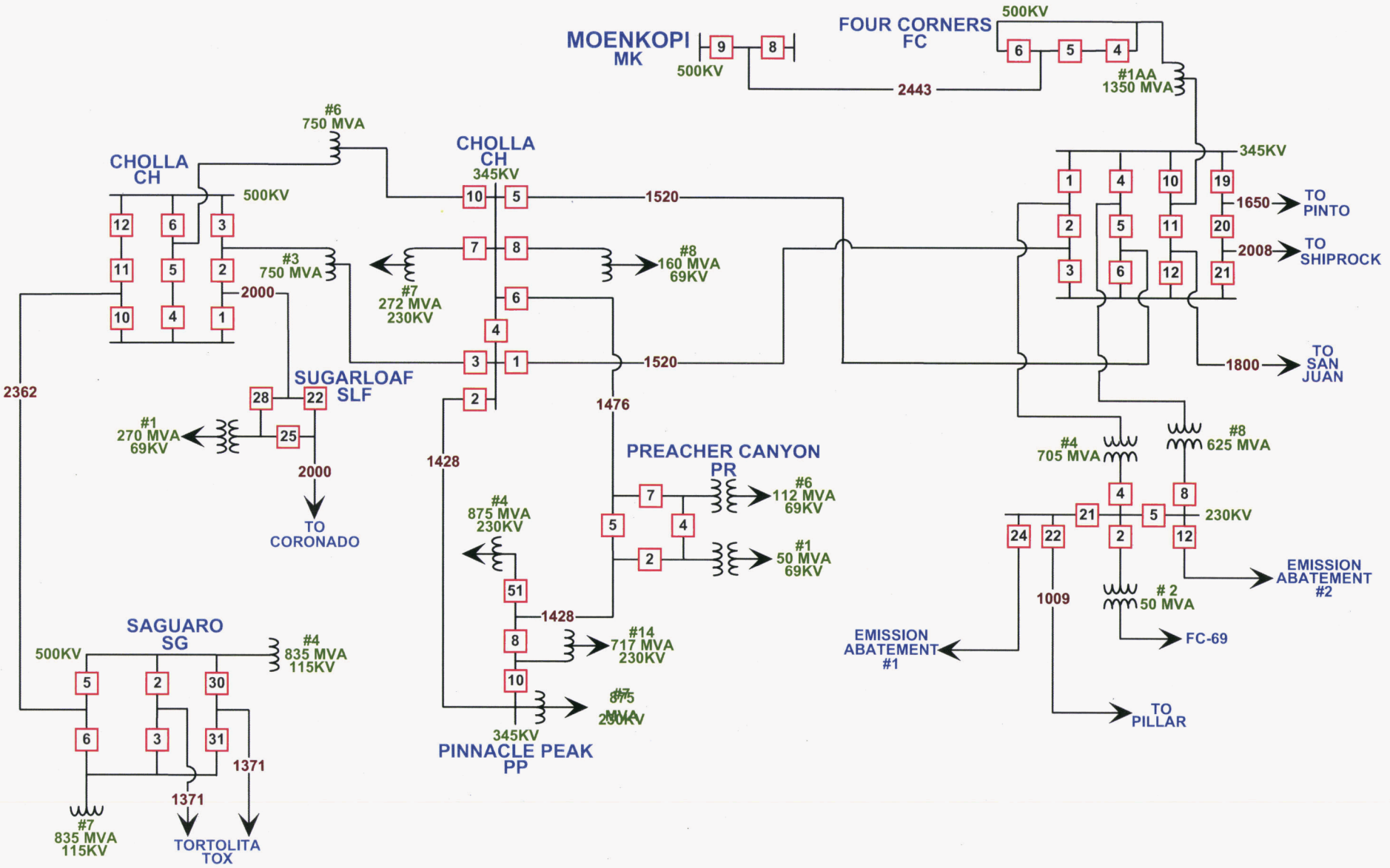


EHV-2

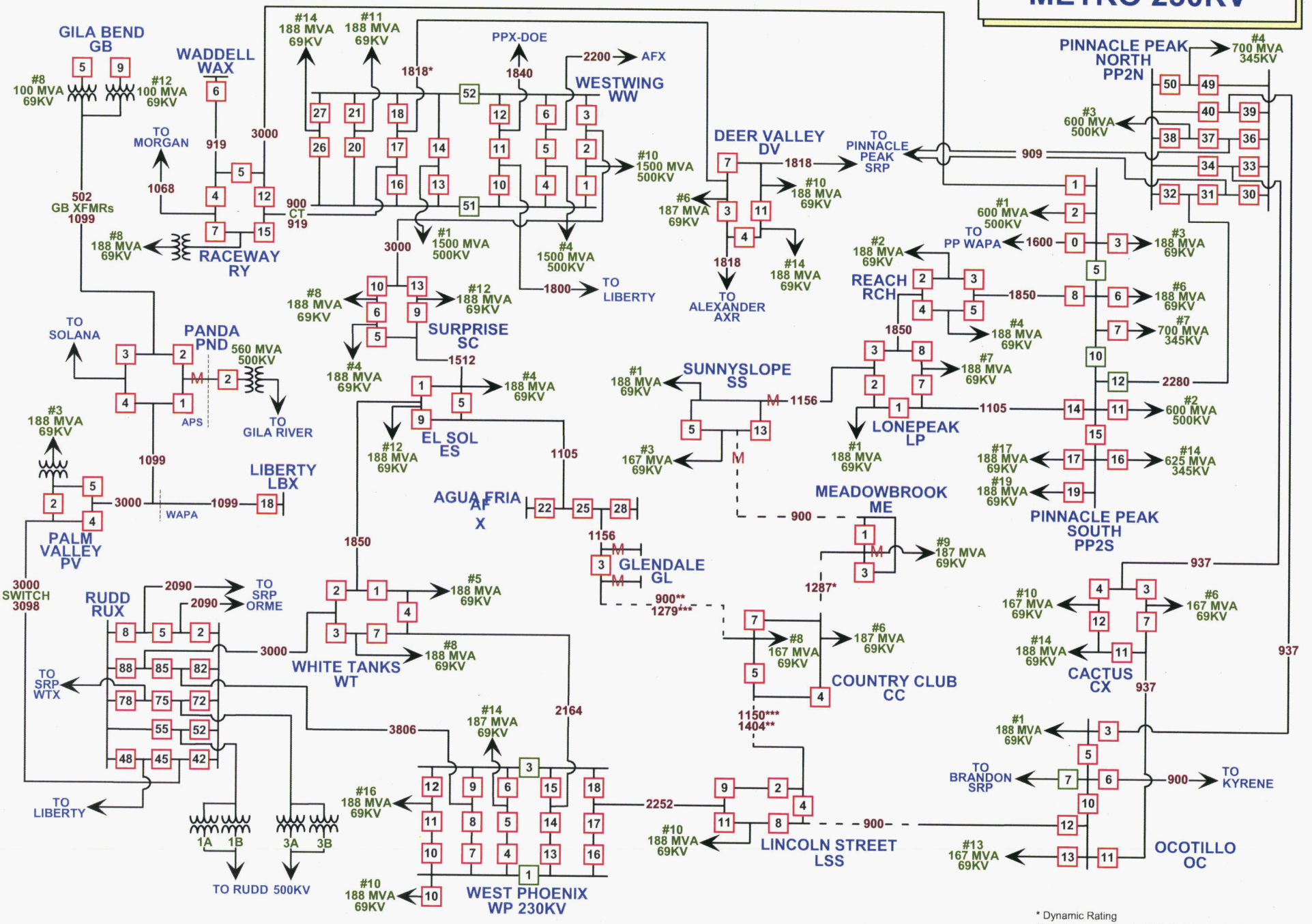

MOENKOPI
MK
500KV
9
8
1810
Capacitors – C7
2444
FOUR CORNERS
FC
500KV
6
5
4
#1AA
1025 MVA
345KV
1
4
10
19
1650
TO
PINTO
2
5
11
20
2008
TO
SHIPROCK
3
6
12
21
1800
TO
SAN
JUAN
#6
500 MVA
CHOLLA
CH
500KV
12
6
3
11
5
2
10
4
1
#3
500 MVA
2000
1750
Capacitors – C15
2364
CHOLLA
CH
345KV
10
5
1150
7
8
#8
143 MVA
69KV
#7
200 MVA
230KV
6
4
3
1
1150
2
1256
1256
SUGARLOAF
SLF
28
22
#1
270 MVA
69KV
25
2000
TO
CORONADO
PREACHER CANYON
PR
7
#6
100 MVA
69KV
5
4
2
#1
50 MVA
69KV
#4
700 MVA
230KV
51
1428
8
#14
625 MVA
230KV
10
#7
700
MVA
230KV
345KV
PINNACLE PEAK
PP
#4
637 MVA
#8
625 MVA
4
8
21
5
230KV
24
22
2
12
780
EMISSION
ABATEMENT
#2
2
50 MVA
FC-69
EMISSION
ABATEMENT
#1
TO
PILLAR
SAGUARO
SG
500KV
#4
725 MVA
115KV
5
2
30
6
3
31
1143
1143
#7
725 MVA
115KV
TORTOLITA
TOX

EMERGENCY RATING (AMPS)

EHV-2
EMERGENCY RATINGS

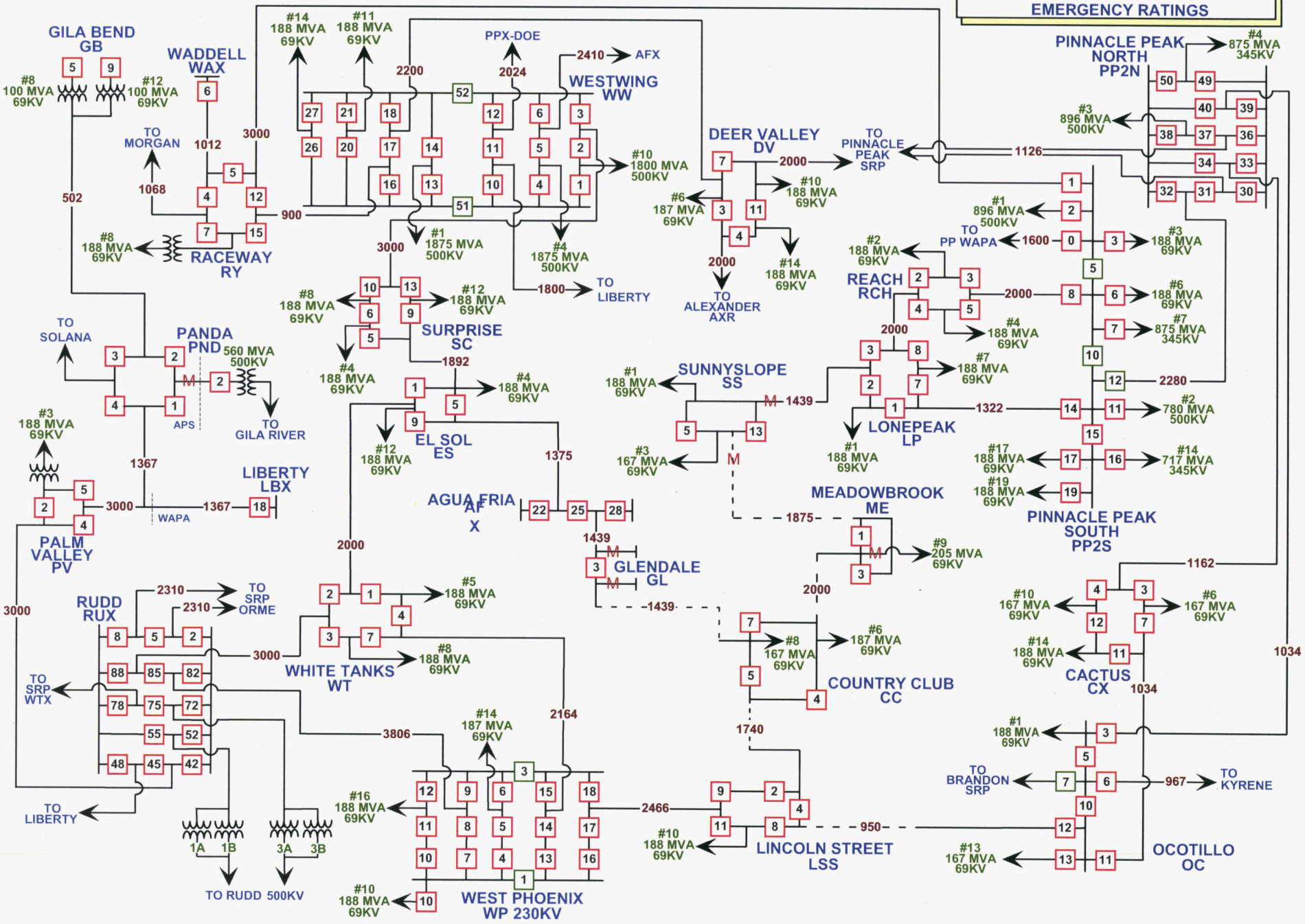


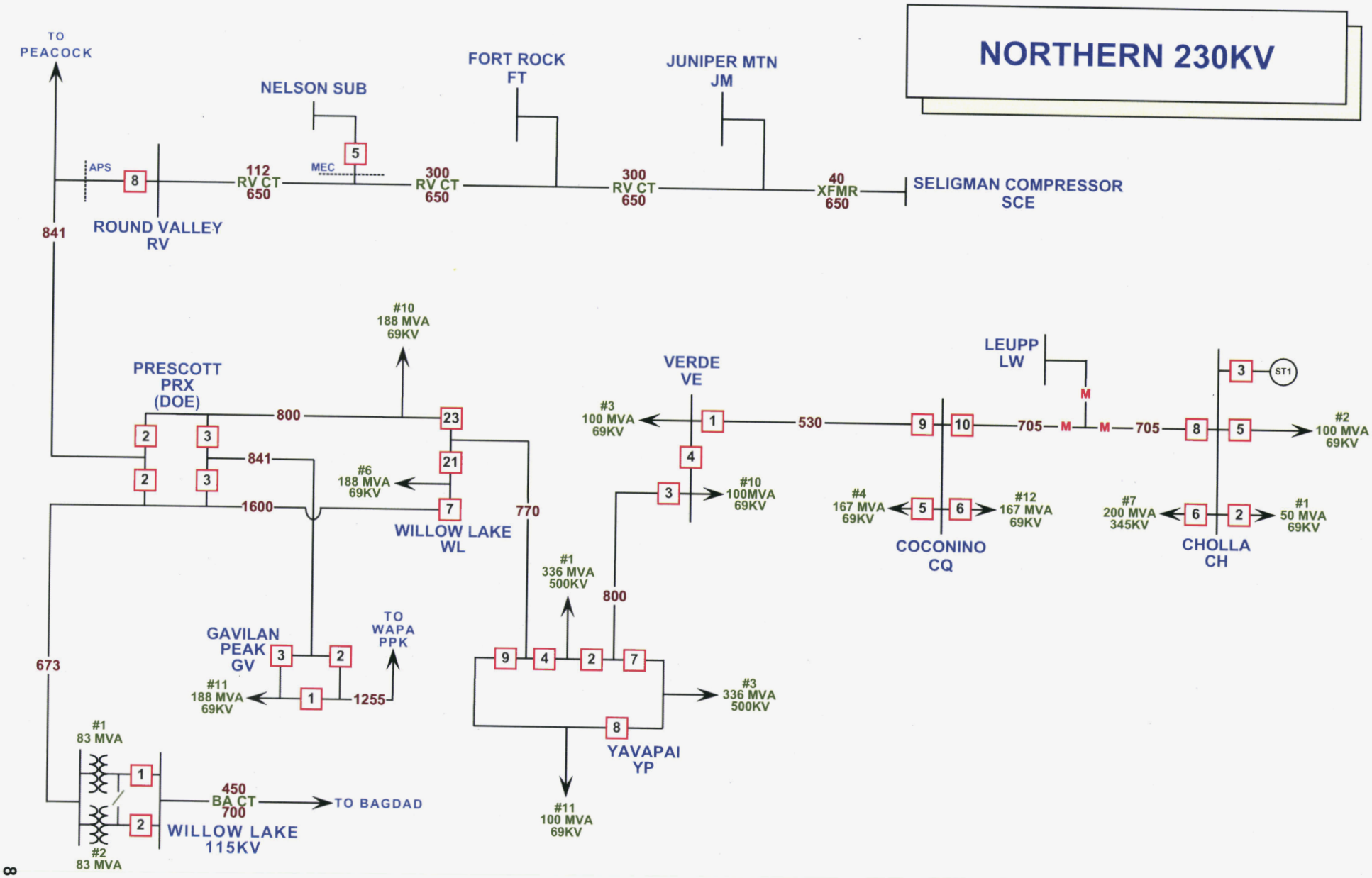
METRO 230KV



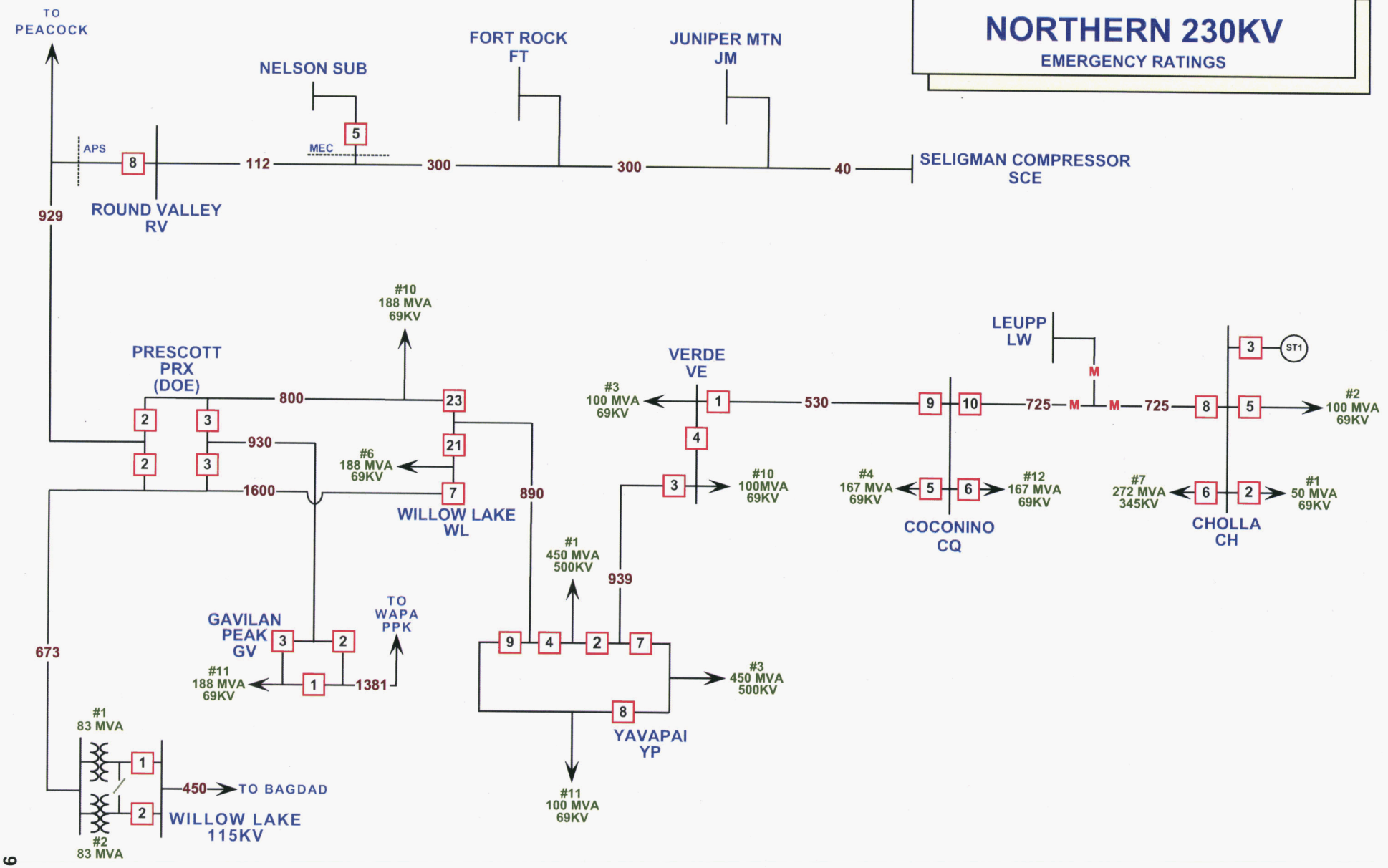
* Dynamic Rating
** No forced cooling on GT-CC, Cooling both ends LS-CC
*** Forced cooling on GT-CC, Cooling one end LS-CC

METRO 230KV
EMERGENCY RATINGS

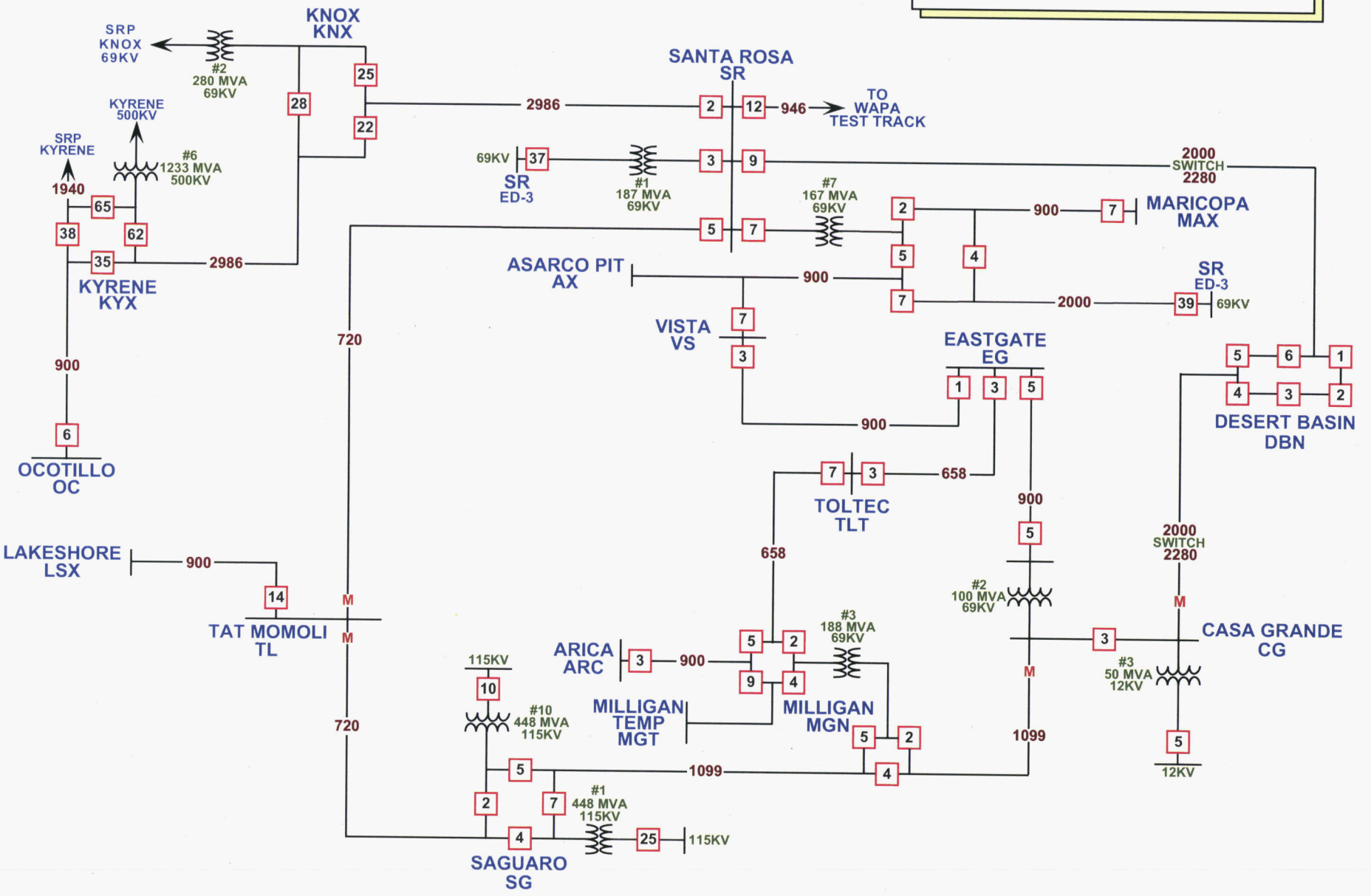


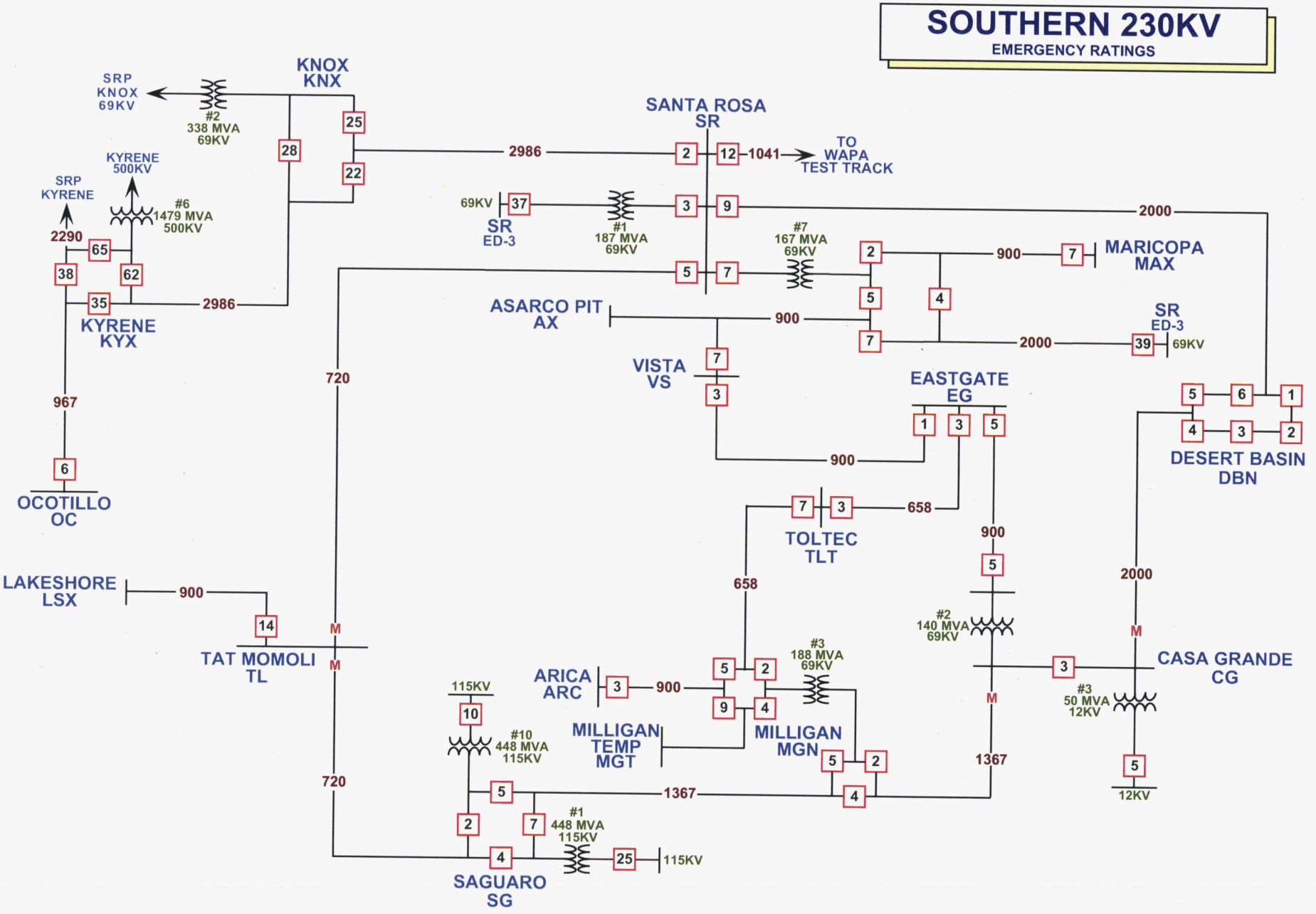

NORTHERN 230KV
TO PEACOCK
NELSON SUB
FORT ROCK FT
JUNIPER MTN JM
APS
MEC
112 RV CT 650
300 RV CT 650
300 RV CT 650
40 XFMR 650
SELIGMAN COMPRESSOR SCE
841
ROUND VALLEY RV
PRESCOTT PRX (DOE)
800
841
1600
#10 188 MVA 69KV
#6 188 MVA 69KV
WILLOW LAKE WL
770
VERDE VE
#3 100 MVA 69KV
530
#10 100MVA 69KV
LEUPP LW
705
705
#2 100 MVA 69KV
#4 167 MVA 69KV
#12 167 MVA 69KV
COCONINO CQ
#7 200 MVA 345KV
#1 50 MVA 69KV
CHOLLA CH
ST1
673
GAVILAN PEAK GV
TO WAPA PPK
#11 188 MVA 69KV
1255
#1 336 MVA 500KV
800
#3 336 MVA 500KV
YAVAPAI YP
#11 100 MVA 69KV
#1 83 MVA
#2 83 MVA
450 BA CT 700
TO BAGDAD
WILLOW LAKE 115KV

NORTHERN 230KV
EMERGENCY RATINGS



SOUTHERN 230KV




SOUTHERN 230KV
EMERGENCY RATINGS
KNOX
KNX
SRP
KNOX
69KV
#2
338 MVA
69KV
25
28
22
2986
SANTA ROSA
SR
2
12
1041
TO
WAPA
TEST TRACK
KYRENE
500KV
SRP
KYRENE
#6
1479 MVA
500KV
2290
65
38
62
35
2986
KYRENE
KYX
69KV
37
SR
ED-3
#1
187 MVA
69KV
3
9
2000
#7
167 MVA
69KV
5
7
2
900
7
MARICOPA
MAX
5
4
ASARCO PIT
AX
900
7
2000
39
69KV
SR
ED-3
VISTA
VS
7
3
720
967
6
OCOTILLO
OC
EASTGATE
EG
1
3
5
900
5
6
1
4
3
2
DESERT BASIN
DBN
7
3
658
TOLTEC
TLT
658
900
5
2000
LAKESHORE
LSX
900
14
M
TAT MOMOLI
TL
M
#2
140 MVA
69KV
M
3
CASA GRANDE
CG
#3
50 MVA
12KV
5
12KV
ARICA
ARC
3
900
5
2
#3
188 MVA
69KV
9
4
115KV
10
#10
448 MVA
115KV
MILLIGAN
TEMP
MGT
MILLIGAN
MGN
5
2
1367
720
5
1367
4
2
7
#1
448 MVA
115KV
4
25
115KV
SAGUARO
SG

ARIZONA PUBLIC SERVICE COMPANY

TEN-YEAR TRANSMISSION SYSTEM PLAN

2013 – 2022

TECHNICAL STUDY REPORT

FOR

THE ARIZONA CORPORATION COMMISSION

JANUARY 2013

Executive Summary

Pursuant to North American Electric Reliability Corporation ("NERC") Standard TPL-001 "System Performance Under Normal (No Contingency) Conditions (Category A)", Arizona Public Service Company ("APS") performs annually a Category A analysis. The Category A analysis is performed for system conditions listed in Table I of the NERC/WECC Planning standards.

Results of the study indicate that, with the projects identified in APS's Ten-Year Transmission System Plan, APS is fully compliant with NERC Standard TPL-001.

Pursuant to NERC Standard TPL-002 "System Performance Following Loss of a Single Bulk Electric System Element (Category B)", APS performs annually a Category B contingency analysis. In Table I of the NERC/WECC planning standards, there are a total of four different Category B events that are to be studied each year to meet NERC Standard TPL-002.

A comprehensive list of contingencies was developed for the Category B contingency analysis and performed for the system conditions listed in Table I of the NERC/WECC Planning standards based on engineering judgment. APS believes that the selection of contingencies for inclusion in these studies, which is based on Category B of Table I of the NERC/WECC Planning standards, is acceptable to WECC. If requested by WECC, APS will implement measures to correct any deficiencies that have been identified by WECC.

Results of the study indicate that, with the projects identified in APS's Ten-Year Transmission System Plan, APS is fully compliant with NERC Standard TPL-002.

Table of Contents

ARIZONA PUBLIC SERVICE COMPANY
2013-2022
TEN-YEAR TRANSMISSION SYSTEM PLAN
TECHNICAL STUDY REPORT

I. Introduction

This technical study report is performed and filed annually with the Arizona Corporation Commission ("Commission") pursuant to ARS § 40-360.02 and Decision No. 63876 (July 25, 2001). This report summarizes the results of power flow analyses and stability analyses for the Arizona Public Service Company ("APS") transmission system.

Power flow analyses were conducted for every year within the ten year planning window (2013-2022) and performed for two scenarios: (i) assumption that all transmission system elements are in service and within continuous ratings (Category A); and (ii) assumption of an outage on a single element, with all remaining system elements remaining within emergency ratings (Category B). Voltage deviations for these scenarios must also be within established guidelines. These voltage deviation guidelines closely approximate post-transient Volt Ampere Reactive ("VAR") margin requirements of the Western Electricity Coordinating Council ("WECC"). More detail is provided in APS's Transmission Planning Process and Guidelines, which is also included in the annual APS Ten-Year Transmission System Plan ("Ten-Year Plan") filing.

The stability analyses were performed to simulate electrical disturbances on the transmission system and evaluate the system response. The desired result is that all generators will remain on line, no additional lines will open, and the system oscillations will damp out.

Results of the power flow and stability analyses aid in determining when and where new electrical facilities are needed because of reliability or security reasons. Additionally, some facilities are planned to address adequacy concerns. These include the interconnection of generation to the transmission system or efforts to increase import capability and/or export/scheduling capability to load-constrained or other areas.

II. Base Case Development

Power flow cases were created for each year of the 2013-2022 study time frame. These cases were developed from the latest available WECC heavy summer power flow cases.

The 2014 heavy summer case was chosen as the first bulk seed case. This case was developed from a 2014 WECC heavy summer base case. This case was then updated in a coordinated effort between Arizona utilities to include the sub-transmission and distribution models. This case was used as the seed case in the creation of the 2013-2017 power flow cases used for the power flow analyses performed for the 2013-2022 Ten-Year plan. Each intermediate case developed was updated with the forecasted loads and any system additions/upgrades that are planned in the respective year. The forecasted

loads modeled within the cases utilized inherently include the effects of distributed renewable generation as well as energy efficiency programs. Forecasted loads modeled within the cases are based on the most recent data at the time the cases are constructed[1].

The second and final seed case chosen was the 2021 heavy summer power flow case that was developed through the CATS and SATS sub-committees of SWAT. In a collaborative effort, the Arizona utilities used the jointly developed 2021 case to develop a 2021 summer case that included the sub-transmission and distribution systems of the Arizona utilities. This seed case was used to develop the 2018-2022 power flow cases. Each intermediate case developed was updated with the forecasted loads and any system additions/upgrades that are planned in the respective year. The forecasted loads modeled within the cases utilized inherently include the effects of distributed renewable generation as well as energy efficiency programs. Forecasted loads modeled within the cases are based on the most recent data at the time the cases are constructed[1].

These cases represent the latest transmission and sub-transmission plans, load projections, and resource plans of utilities and independent power producers. By utilizing WECC base cases, all loads, resources, firm power transfers, and planned projects within the WECC system are represented. By using jointly developed seed cases the most accurate Arizona system is represented.

[1] Load forecasts for the 2013-2022 TYP are based on APS load forecasts as of Q1 2012 that incorporate demand side management and energy efficiency, including distributed generation.

III. Power Flow Analyses

Base case and single contingency conditions are evaluated to determine system needs and timing. Various iterations of possible solutions lead to the final plans for transmission additions. The contingency analysis involves simulations for every non-radial 115kV or above line that APS owns, partially owns, or operates. Transformer as well as generator outages are also evaluated.

The APS system includes several reactive power resources that are used to maintain bus voltages within the limits defined by APS's Transmission Planning Process & Guidelines. These reactive power resources include shunt devices, series compensation, and tap changing transformers. The reactive power resources are adequate and meet the system performance.

APS does not have any additional existing or planned voltage or power flow control devices except those noted in the preceding paragraph. These devices exist outside the APS control area; however, they are not utilized or their operation is not necessary as a result of the contingencies in this study.

No planned outage of bulk electric equipment at APS occurs during the heavy summer peak time. Therefore, it is not necessary to study planned outages since this Ten-Year Plan study focuses on the heavy summer peak time.

Results of the power flow studies are tabulated in a Security Needs Table and an Adequacy Needs Table, below. These tables identify 12 transmission projects that are included in this Ten-Year Plan filing. Some of the projects were classified as Adequacy Needs because of the uncertainty of generation location, project size, and transmission availability in the later years. As projects near the five-year planning time frame, they may be redefined as Security Needs projects. For the projects included in the Security Needs Table, selected maps of the power flow simulations are contained in Appendix B showing the pre-project scenario (outage and resulting violation) and the post-project scenario (outage and no criteria violations).

Table 1: Security Needs Table

Transmission Project	In Service Year	Critical Outage	Limiting Element/Condition	Map
Youngs Canyon (Flagstaff) 345/69kV interconnection	2013	230/69kV transformers at Coconino	Voltage deviations on the sub-transmission system in the area resulting in load shedding	B2-B3
Palm Valley-TS2-Trilby Wash (TS1) 230kV line and Trilby Wash 230/69kV substation	2015	Westwing 230/69kV Transformer	Overloads remaining Westwing 230/69kV Transformer	B4-B5
		McMicken-Westwing 69kV line	Overloads McMicken-Surprise 69kV line	B6-B7
Mazatzal 345kV substation	2017	Preacher Canyon – Owens 69kV line, or Owens – Tonto 69kV line	Voltage deviations on the sub-transmission system in the area resulting in load shedding	B8-B9
Saguaro (TS12): Relocate the 230kV yard and install a 230/69kV Transformer	2021	N/A	New development in the area is increasing the load beyond the capability of the existing 12kV system at Saguaro. Currently there is no 69kV in the area, therefore a new 69kV source is needed.	N/A

Table 2: Adequacy Needs Table

Transmission Project	In Service Year	System Benefits
Palo Verde Hub-North Gila 500kV #2 line.	2015	Increases import capability for the Yuma area and export/scheduling capability from the PV area to provide access to both solar and gas resources. Increases transmission system reliability and ability to deliver power from these resources.
North Gila-TS8 230kV line.	2016	Increases transmission system reliability and ability to distribute and deliver power within the Yuma area.
Palo Verde-Delaney	2016	Increases the export scheduling capability from the Palo Verde ("PV") area to provide access to both solar and gas resources. The project is also to provide for the interconnection of 4 solar generation projects into the Delaney switchyard.
Delaney-Sun Valley 500kV line	2016	Increases the import capability for the Phoenix Metropolitan area and export/scheduling capability from the PV area to provide access to both solar and gas resources. Along with the Sun Valley-Trilby Wash 230kV line, provides a new Transmission source for power in the far north and west sides of the Phoenix Metropolitan transmission system.
Sun Valley-Trilby Wash 230kV line	2016	Provides a second 230kV source for Trilby Wash so that it is not served as a radial substation, thereby increasing the local system reliability. With the 500kV source at Sun Valley, the project provides a new source for power in the far north and west sides of the Phoenix Metropolitan transmission system.
Sun Valley-Morgan 500kV line	2018	Increases import capability for the Phoenix Metropolitan area and export/scheduling capability from the PV area which includes both solar and gas resources. Increases transmission system reliability and ability to deliver power from these resources. Provides a second 500kV source for the Sun Valley substation. Provides support for multiple transmission corridor contingencies.

IV. Stability Analyses

A stability simulation for simulated three-phase faults was performed for 2014 and 2021 for every non-radial 345kV and 500kV, and select 230 kV lines that APS owns (totally or partially) or operates. It has been APS's experience that stability concerns do not manifest on the sub-transmission system, which is primarily designed to deliver power to load. Therefore, no simulations were performed at voltage levels less than 115kV, with the possible exception of generators or generator step up transformers at the generator substation. Additionally, every new proposed generation plant will be required to perform stability evaluations prior to receiving permission to interconnect to the transmission system.

Existing and planned protection systems are utilized in the study, including any backup or redundant system, and represent fault clearing times, the operation of the protection system, and the resulting removal of the facility that would occur as a result of the simulated event. Each simulation modeled a 3-phase bus fault, appropriate series capacitor flashing and reinsertion, fault removal, and transmission line removal. System performance was evaluated by monitoring representative generator rotor angles, bus voltages and system frequency. Plots of these system parameters are included in Appendices C and D. The stability simulations performed to date indicate that no stability problems limit the transmission system.

V. Category A & B Contingency Study Results

A high level overview of the results for the Category A and Category B contingences is shown in Table 3. From this table, it is shown that each of the Category A and Category B contingencies meets the NERC/WECC Planning Standards.

Table 3: Overview of Category A & B Standard Results

		1-5 year Time Frame		6-10 year Time Frame	
	NERC Planning Standards Category A	**Case Years Studied**	**Standards Met?**	**Case Years Studied**	**Standards Met?**
1	All Facilities in Service	2013 through 2017	Yes	2018 through 2022	Yes
		1-5 year Time Frame		**6-10 year Time Frame**	
	NERC Planning Standards Category B	**Case Years Studied**	**Standards Met?**	**Case Years Studied**	**Standards Met?**
1	3-Phase Fault with Normal Clearing – Generator	2013 through 2017	Yes	2018 through 2022	Yes
2	3-Phase Fault with Normal Clearing – Transmission Circuit	2013 through 2017	Yes	2018 through 2022	Yes
3	3-Phase Fault with Normal Clearing – Transformer	2013 through 2017	Yes	2018 through 2022	Yes
4	Loss of an Element without a Fault	2013 through 2017	Yes	2018 through 2022	Yes

Table 3 is a high level summary that shows, with the projects listed in Tables 1 & 2, the APS system meets the criteria listed in NERC Standards TPL-001 and TPL-002. The transient stability plots are detailed in Appendices C & D. Due to the size of the

power flow thermal and voltage steady state analysis the detailed results are not included. However, they are available upon request by WECC or any other authorized stakeholder.

APPENDIX A

Representative Contingency List
(2013 used as an example year)

Outage Number	2013 Type	Single Contingency List (Category B) Contingency	Circuit Number
line_1	Line	461E5.1N 115 to MRMNFLAT 115	Circuit 1
line_2	Line	461E5.1N 115 to STEWMTN1 115	Circuit 1
line_3	Line	842E2.7N 115 to 843E2.7N 115	Circuit 1
line_4	Line	A-R 115 to SANJUAN 115	Circuit 1
line_5	Line	A-R 115 to TURLY_S 115	Circuit 1
line_6	Line	ABEL 230 to DINOSAUR 230	Circuit 1
line_7	Line	ABEL 230 to RANDOLPH 230	Circuit 1
line_8	Line	ABEL 230 to RS-24 230	Circuit 1
line_9	Line	ABEL 230 to SCHRADER 230	Circuit 1
line_10	Line	ABEL 500 to BROWNING 500	Circuit 1
line_11	Line	ADAMS 115 to ADAMSTAP 115	Circuit 1
line_12	Line	ADAMSTAP 115 to APACHE 115	Circuit 1
line_13	Line	ADAMSTAP 115 to NOGALES 115	Circuit 1
line_14	Line	AGUAFRIA 230 to ALEXANDR 230	Circuit 1
line_15	Line	AGUAFRIA 230 to WESTWNGW 230	Circuit 1
line_16	Line	AGUAFRIA 230 to WHITETNK 230	Circuit 1
line_17	Line	ALEXNDR 230 to ALEXANDR 230	Circuit 1
line_18	Line	ANDERSON 230 to KYR-EAST 230	Circuit 1
line_19	Line	ANIMAS 115 to BLUFVIEW 115	Circuit 1
line_20	Line	ANIMAS 115 to SULLIVAN 115	Circuit 1
line_21	Line	APACHE 115 to HAYDENAZ 115	Circuit 1
line_22	Line	APACHE 230 to BUTERFLD 230	Circuit 1
line_23	Line	APACHE 230 to RED TAIL 230	Circuit 1
line_24	Line	APACHE 230 to WINCHSTR 230	Circuit 1
line_25	Line	ASARCOSR 115 to ASARCOTP 115	Circuit 1
line_26	Line	ASARCOTP 115 to CRUSHER 115	Circuit 1
line_27	Line	ASARCOTP 115 to HAYDENAZ 115	Circuit 1
line_28	Line	AVERY 230 to RACEWAY 230	Circuit 1
line_29	Line	AVERY 230 to SCTWSH 230	Circuit 1
line_30	Line	AVRA 115 to MARANA 115	Circuit 1
line_31	Line	AVRA 115 to SNDARIO 115	Circuit 1
line_32	Line	BC TAP 230 to MEAD N 230	Circuit
line_33	Line	BERGIN 115 to LAKEVIEW 115	Circuit 1
line_34	Line	BERGIN 115 to WESTFORK 115	Circuit 1
line_35	Line	BICKNELL 115 to THREEPNT 115	Circuit 1
line_36	Line	BICKNELL 345 to VAIL 345	Circuit 1
line_37	Line	BLACKMTN 115 to BLKMTNAZ 115	Circuit 1
line_38	Line	BLACKMTN 115 to DEL BAC 115	Circuit 1

Outage Number	2013 Type	Single Contingency List (Category B) Contingency	Circuit Number
line_39	Line	BLACKMTN 115 to SNYDHILL 115	Circuit 1
line_40	Line	BLUFVIEW 115 to MESA FM 115	Circuit 1
line_41	Line	BLYTHE 161 to BLYTHEAZ 161	Circuit 1
line_42	Line	BLYTHE 161 to BLYTHESC 161	Circuit 1
line_43	Line	BLYTHE 161 to BUCKBLVD 161	Circuit 1
line_44	Line	BLYTHE 161 to GLT TAP 161	Circuit 1
line_45	Line	BLYTHE 161 to HEADGATE 161	Circuit 1
line_46	Line	BLYTHE 161 to NILAND 161	Circuit 1
line_47	Line	BONNEYTP 115 to BONNEYBK 115	Circuit 1
line_48	Line	BONNEYTP 115 to COOLIDGE 115	Circuit 1
line_49	Line	BONNEYTP 115 to CRUSHER 115	Circuit 1
line_50	Line	BOOTHILL 115 to ADAMS 115	Circuit 1
line_51	Line	BOOTHILL 115 to MURAL 115	Circuit 1
line_52	Line	BOUSE 161 to BLACK PK 161	Circuit 1
line_53	Line	BOUSE 161 to BOUSE AZ 161	Circuit 1
line_54	Line	BOUSE 161 to KOFA 161	Circuit 1
line_55	Line	BRADY 115 to BRADYAZ 115	Circuit 1
line_56	Line	BRADY 115 to PICACHOW 115	Circuit 1
line_57	Line	BRANDOW 230 to KYR-EAST 230	Circuit 1
line_58	Line	BRANDOW 230 to PAPAGOBT 230	Circuit 1
line_59	Line	BRANDOW 230 to WARD 230	Circuit 1
line_60	Line	BRANDOW 230 to WARD 230	Circuit 2
line_61	Line	BRAWLEY 115 to BRAWLYAZ 115	Circuit 1
line_62	Line	BRAWLEY 115 to SANXAVER 115	Circuit 1
line_63	Line	BROWNING 230 to DINOSAUR 230	Circuit 1
line_64	Line	BROWNING 230 to SANTAN 230	Circuit 1
line_65	Line	BROWNING 500 to SILVERKG 500	Circuit 1
line_66	Line	BUCKEYE 230 to LIBERTY 230	Circuit 1
line_67	Line	BUCKEYE 230 to BUCKEYE2 230	Circuit 1
line_68	Line	BUTERFLD 230 to PANTANO 230	Circuit 1
line_69	Line	BUTERFLD 230 to SAN RAF 230	Circuit 1
line_70	Line	CACTUS 230 to OCOTILLO 230	Circuit 1
line_71	Line	CACTUS 230 to PPAPS N 230	Circuit 1
line_72	Line	CAMINO 230 to MEAD S 230	Circuit E
line_73	Line	CAMINO 230 to MEAD S 230	Circuit W
line_74	Line	CANEZ 115 to SONOITA 115	Circuit 1
line_75	Line	CANEZ 138 to SONOITA 138	Circuit 1
line_76	Line	CARLOTA 115 to PINTOVLY 115	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_77	Line	CARLOTA 115 to SILVERK2 115	Circuit 1
line_78	Line	CARREL 115 to GOLDFELD 115	Circuit 1
line_79	Line	CARREL 115 to SPURLOCK 115	Circuit 1
line_80	Line	CASGRAPS 230 to DBG 230	Circuit 1
line_81	Line	CHOLLA 230 to LEUPP 230	Circuit 1
line_82	Line	CHOLLA 345 to MAZATZAL 345	Circuit 1
line_83	Line	CHOLLA 345 to PNPKAPS 345	Circuit 1
line_84	Line	CHOLLA 345 to PRECHCYN 345	Circuit 1
line_85	Line	CHOLLA 500 to SAGUARO 500	Circuit 1
line_86	Line	COCONINO 230 to VERDE S 230	Circuit 1
line_87	Line	COLLTAP 115 to COLLEG 115	Circuit 1
line_88	Line	COLLTAP 115 to HOODMESA 115	Circuit 1
line_89	Line	COLLTAP 115 to SULLIVAN 115	Circuit 1
line_90	Line	COOLIDGE 115 to COOLDGAZ 115	Circuit 1
line_91	Line	COOLIDGE 115 to ED-2 115	Circuit 1
line_92	Line	COOLIDGE 115 to SIGNAL 115	Circuit 1
line_93	Line	COOLIDGE 115 to VLYFARMS 115	Circuit 1
line_94	Line	COOLIDGE 230 to SUN ARIZ 230	Circuit 1
line_95	Line	COOLIDGE 230 to SUN ARIZ 230	Circuit 2
line_96	Line	COPPERVR 230 to FRISCO 230	Circuit 1
line_97	Line	CORBELL 230 to KYR-EAST 230	Circuit 1
line_98	Line	CORONADO 500 to SGRLF 500	Circuit 1
line_99	Line	CORONADO 500 to SILVERKG 500	Circuit 1
line_100	Line	CTRYCLUB 230 to GRNDTRML 230	Circuit 1
line_101	Line	CTRYCLUB 230 to LINCSTRT 230	Circuit 1
line_102	Line	DAVIS 230 to MCCULLGH 230	Circuit 1
line_103	Line	DAVIS 230 to MEAD N 230	Circuit 1
line_104	Line	DAVIS 230 to RIVIERA 230	Circuit 1
line_105	Line	DAVIS 230 to TOPOCK 230	Circuit 2
line_106	Line	DAVIS 230 to LONGTIN 230	Circuit 1
line_107	Line	DEERVALY 230 to ALEXANDR 230	Circuit 1
line_108	Line	DEERVALY 230 to PINPKSRP 230	Circuit 1
line_109	Line	DEERVALY 230 to WESTWNGE 230	Circuit 1
line_110	Line	DEL BAC 115 to NOGALES 115	Circuit 1
line_111	Line	DELANY 500 to SNVLY 500	Circuit 1
line_112	Line	DOSCONDO 230 to HACKBERY 230	Circuit 1
line_113	Line	DUGAS 500 to MORGAN 500	Circuit 1
line_114	Line	EAGLEYE 230 to BUCKEYE2 230	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_115	Line	ED-2 115 to BRADY 115	Circuit 1
line_116	Line	ED-2 115 to ED-4 115	Circuit 1
line_117	Line	ED-2 115 to SIGNAL 115	Circuit 1
line_118	Line	ED-4 115 to ED-5 115	Circuit 1
line_119	Line	ED-5B 115 to ED-5 115	Circuit 1
line_120	Line	ED-5B 115 to EMPIRE 115	Circuit 1
line_121	Line	EL SOL 230 to AGUAFRIA 230	Circuit 1
line_122	Line	ELLISON 115 to 843E2.7N 115	Circuit 1
line_123	Line	EMPIRE 115 to CASAGRND 115	Circuit 1
line_124	Line	EQUEST N 500 to MEAD 500	Circuit 1
line_125	Line	FLAGSTAF 345 to GLENCANY 345	Circuit 1
line_126	Line	FLAGSTAF 345 to GLENCANY 345	Circuit 2
line_127	Line	FLAGSTAF 345 to PINPKBRB 345	Circuit 1
line_128	Line	FLAGSTAF 345 to PINPKBRB 345	Circuit 2
line_129	Line	FLAGSTAF 345 to YOUNGSCY 345	Circuit 1
line_130	Line	FOOTHILS 115 to HOODMESA 115	Circuit 1
line_131	Line	FOOTHILS 115 to LAKEVIEW 115	Circuit 1
line_132	Line	FORTROCK 230 to JUNIPRMT 230	Circuit 1
line_133	Line	FORTROCK 230 to RNDVLYAZ 230	Circuit 1
line_134	Line	FOURCORN 230 to PILLAR 230	Circuit 1
line_135	Line	FOURCORN 345 to CHOLLA 345	Circuit 1
line_136	Line	FOURCORN 345 to CHOLLA 345	Circuit 2
line_137	Line	FOURCORN 345 to RIOPUERC 345	Circuit 1
line_138	Line	FOURCORN 345 to SAN_JUAN 345	Circuit 1
line_139	Line	FOURCORN 345 to WESTMESA 345	Circuit 1
line_140	Line	FOURCORN 500 to MOENKOPI 500	Circuit 1
line_141	Line	FRAZIER 115 to HORSMESA 115	Circuit 1
line_142	Line	FRAZIER 115 to MOONSHIN 115	Circuit 1
line_143	Line	FRAZIER 115 to ROOSEVLT 115	Circuit 1
line_144	Line	FRUITAP 115 to FRUITLND 115	Circuit 1
line_145	Line	FRUITAP 115 to HOODMESA 115	Circuit 1
line_146	Line	GALLEGOS 115 to BERGIN 115	Circuit 1
line_147	Line	GASCLEAN 115 to 843E2.7N 115	Circuit 1
line_148	Line	GATEWAY 115 to VALNCIA 115	Circuit 1
line_149	Line	GATEWAY 138 to VALNCIA 138	Circuit 1
line_150	Line	GAVILNPK 230 to GAVLINWA 230	Circuit 1
line_151	Line	GAVLINWA 230 to PRSCOTWA 230	Circuit 1
line_152	Line	GILA 161 to DOME TAP 161	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_153	Line	GILA 161 to KNOB 161	Circuit 1
line_154	Line	GILARIVR 230 to GILABEND 230	Circuit 1
line_155	Line	GLADETAP 115 to ELPASOTP 115	Circuit 1
line_156	Line	GLADETAP 115 to LAPLATA 115	Circuit 1
line_157	Line	GLEN PS 230 to NAVAJO 230	Circuit 1
line_158	Line	GLENDALE 230 to AGUAFRIA 230	Circuit 1
line_159	Line	GLENDALE 230 to GRNDTRML 230	Circuit 1
line_160	Line	GLT TAP 161 to KNOB 161	Circuit 1
line_161	Line	GOLDFELD 115 to 461E5.1N 115	Circuit 1
line_162	Line	GOLDFELD 115 to HORSMESA 115	Circuit 1
line_163	Line	GRIFFITH 230 to PEACOCK 230	Circuit 1
line_164	Line	H ALLEN 500 to MEAD 500	Circuit 1
line_165	Line	H-H 115 to HARE 115	Circuit 1
line_166	Line	HACKBERY 230 to MORENCI 230	Circuit 1
line_167	Line	HARCUVAR 230 to HARCU AZ 230	Circuit 1
line_168	Line	HARCUVAR 230 to HASSYTAP 230	Circuit 1
line_169	Line	HARE 115 to ENRON 115	Circuit 1
line_170	Line	HARE 115 to MILAGR 115	Circuit 1
line_171	Line	HARE 115 to TURLY_S 115	Circuit 1
line_172	Line	HARE 115 to WESTFORK 115	Circuit 1
line_173	Line	HARTCYN 115 to GLADETAP 115	Circuit 1
line_174	Line	HARTCYN 115 to H-H 115	Circuit 1
line_175	Line	HASSYAMP 500 to ARLINTON 500	Circuit 1
line_176	Line	HASSYAMP 500 to HARQUAHA 500	Circuit 1
line_177	Line	HASSYAMP 500 to JOJOBA 500	Circuit 1
line_178	Line	HASSYAMP 500 to MESQUIT2 500	Circuit 2
line_179	Line	HASSYAMP 500 to MESQUITE 500	Circuit 1
line_180	Line	HASSYAMP 500 to N.GILA 500	Circuit 1
line_181	Line	HASSYAMP 500 to PALOVRDE 500	Circuit 1
line_182	Line	HASSYAMP 500 to PALOVRDE 500	Circuit 2
line_183	Line	HASSYAMP 500 to PINAL_W 500	Circuit 1
line_184	Line	HASSYAMP 500 to REDHAWK 500	Circuit 1
line_185	Line	HASSYAMP 500 to REDHAWK 500	Circuit 2
line_186	Line	HASSYAMP 500 to HDWSH 500	Circuit 1
line_187	Line	HASSYTAP 230 to HASSY AZ 230	Circuit 1
line_188	Line	HASSYTAP 230 to LIBERTY 230	Circuit 1
line_189	Line	HAYDENAZ 115 to KEARNYTP 115	Circuit 1
line_190	Line	HENDRSON 230 to MEAD N 230	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_191	Line	HIDALGO 345 to GREENLEE 345	Circuit 1
line_192	Line	HILLTOP 230 to MCCONICO 230	Circuit 1
line_193	Line	HORSMESA 115 to MRMNFLAT 115	Circuit 1
line_194	Line	HOVRA1A2 230 to MEAD S 230	Circuit 1
line_195	Line	HOVRA5A6 230 to MEAD S 230	Circuit 1
line_196	Line	HOVRA7-9 230 to MEAD S 230	Circuit 1
line_197	Line	HOVRN1N2 230 to MEAD S 230	Circuit 1
line_198	Line	HOVRN3N4 230 to MEAD S 230	Circuit 1
line_199	Line	HOVRN5N6 230 to MEAD S 230	Circuit 1
line_200	Line	HOVRN7N8 230 to MEAD S 230	Circuit 1
line_201	Line	JOJOBA 230 to GILARIVR 230	Circuit 1
line_202	Line	JOJOBA 500 to GILARIVR 500	Circuit 1
line_203	Line	JOJOBA 500 to GILARIVR 500	Circuit 2
line_204	Line	JOJOBA 500 to KYRENE 500	Circuit 1
line_205	Line	JUNIPRMT 230 to SELIGMAN 230	Circuit 1
line_206	Line	KANTOR 115 to CANEZ 115	Circuit 1
line_207	Line	KANTOR 138 to CANEZ 138	Circuit 1
line_208	Line	KANTOR 138 to TUBAC 138	Circuit 1
line_209	Line	KAYENTA 230 to LNGHOUSE 230	Circuit 1
line_210	Line	KAYENTA 230 to SHIPROCK 230	Circuit 1
line_211	Line	KEARNY 115 to KEARNYTP 115	Circuit 1
line_212	Line	KEARNYTP 115 to MORRISAZ 115	Circuit 1
line_213	Line	KNOB 161 to PILOTKNB 161	Circuit 1
line_214	Line	KNOLL 115 to MORRISAZ 115	Circuit 1
line_215	Line	KNOX 230 to SNTAROSA 230	Circuit 1
line_216	Line	KOFA 161 to DOME TAP 161	Circuit 1
line_217	Line	KYR-WEST 230 to KNOX 230	Circuit 1
line_218	Line	KYR-WEST 230 to OCOTILLO 230	Circuit 1
line_219	Line	KYR-EAST 230 to SCHRADER 230	Circuit 1
line_220	Line	KYRENE 500 to BROWNING 500	Circuit 1
line_221	Line	LEUPP 230 to COCONINO 230	Circuit 1
line_222	Line	LIBERTY 230 to LIBTYPHS 230	Circuit 1
line_223	Line	LIBERTY 230 to LONE BUT 230	Circuit 1
line_224	Line	LIBERTY 230 to PHXWAPA 230	Circuit 1
line_225	Line	LIBERTY 230 to RUDD 230	Circuit 1
line_226	Line	LIBERTY 230 to TS4 230	Circuit 1
line_227	Line	LIBERTY 230 to WESTWNGW 230	Circuit 1
line_228	Line	LIBERTY 345 to PEACOCK 345	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_229	Line	LINCSTRT 230 to OCOTILLO 230	Circuit 1
line_230	Line	LINCSTRT 230 to WPHXAPSN 230	Circuit 1
line_231	Line	LONE BUT 230 to SUN ARIZ 230	Circuit 1
line_232	Line	LONE BUT 230 to TESTTRAK 230	Circuit 1
line_233	Line	LONEPEAK 230 to PPAPS E 230	Circuit 1
line_234	Line	LONEPEAK 230 to SUNYSLOP 230	Circuit 1
line_235	Line	MARANA 115 to RATTLSNK 115	Circuit 1
line_236	Line	MAZATZAL 345 to PNPKAPS 345	Circuit 1
line_237	Line	MCCONICO 230 to DAVIS 230	Circuit 1
line_238	Line	MCCONICO 230 to GRIFFITH 230	Circuit 1
line_239	Line	MCCONICO 230 to HARRIS 230	Circuit 1
line_240	Line	MEAD 500 to MARKETPL 500	Circuit 1
line_241	Line	MEAD 500 to PERKINS 500	Circuit 1
line_242	Line	MEAD N 230 to ARDEN 230	Circuit 1
line_243	Line	MEAD N 230 to DECATUR 230	Circuit 1
line_244	Line	MEAD N 230 to EASTSIDE 230	Circuit 1
line_245	Line	MEAD N 230 to EQUEST 230	Circuit 2
line_246	Line	MEAD N 230 to HVRA3A4 230	Circuit 1
line_247	Line	MEAD N 230 to NEWPORT 230	Circuit 1
line_248	Line	MEAD S 230 to DIAMOND 230	Circuit 1
line_249	Line	MEAD S 230 to ELDORDO 230	Circuit 1
line_250	Line	MEAD S 230 to ELDORDO 230	Circuit 2
line_251	Line	MEAD S 230 to EQUEST 230	Circuit 1
line_252	Line	MEAD S 230 to GREENWAY 230	Circuit 1
line_253	Line	MEAD S 230 to MCCULLGH 230	Circuit 1
line_254	Line	MEAD S 230 to MCCULLGH 230	Circuit 2
line_255	Line	MEAD S 230 to MEAD N 230	Circuit 1
line_256	Line	MEAD S 230 to PAHRUMP 230	Circuit 1
line_257	Line	MEADOWBK 230 to CTRYCLUB 230	Circuit 1
line_258	Line	MEADOWBK 230 to SUNYSLOP 230	Circuit 1
line_259	Line	MIAMI 115 to 843E2.7N 115	Circuit 1
line_260	Line	MIAMI 115 to MIAMI 3 115	Circuit 1
line_261	Line	MIAMI 115 to PINAL 115	Circuit 1
line_262	Line	MIAMI 115 to PINTOVLY 115	Circuit 1
line_263	Line	MIAMI 3 115 to MIAMI 4 115	Circuit 1
line_264	Line	MIAMI 3 115 to PINAL 115	Circuit 1
line_265	Line	MIAMI 4 115 to 843E2.7N 115	Circuit 1
line_266	Line	MILLIGAN 230 to CASGRAPS 230	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_267	Line	MILLIGAN 230 to TS12 230	Circuit 1
line_268	Line	MOENKOPI 500 to ELDORDO 500	Circuit 1
line_269	Line	MOENKOPI 500 to YAVAPAI 500	Circuit 1
line_270	Line	MOENKOPI 500 to CEDARMT 500	Circuit 1
line_271	Line	MOONSHIN 115 to 842E2.7N 115	Circuit 1
line_272	Line	MOONSHIN 115 to PINAL 115	Circuit 1
line_273	Line	MORENCI 230 to GREEN-SW 230	Circuit 1
line_274	Line	MORENCI 230 to PD-MORNC 230	Circuit 1
line_275	Line	MORGAN 500 to PNPKAPS 500	Circuit 1
line_276	Line	N.HAVASU 230 to PARKER 230	Circuit 1
line_277	Line	N.HAVASU 230 to TOPOCK 230	Circuit 1
line_278	Line	N.WADDEL 230 to RACEWYWA 230	Circuit 1
line_279	Line	NAVAJO 115 to SAN JUAN 115	Circuit 1
line_280	Line	NAVAJO 230 to LNGHOUSE 230	Circuit 1
line_281	Line	NAVAJO 500 to CRYSTAL 500	Circuit 1
line_282	Line	NAVAJO 500 to DUGAS 500	Circuit 1
line_283	Line	NAVAJO 500 to MOENKOPI 500	Circuit 1
line_284	Line	NEWTUCSN 230 to SAHUARIT 230	Circuit 1
line_285	Line	NOGALES 115 to KANTOR 115	Circuit 1
line_286	Line	NOGALES 138 to KANTOR 138	Circuit 1
line_287	Line	OAKFLAT 115 to SILVERT1 115	Circuit 1
line_288	Line	OAKFLAT 115 to TRASK 115	Circuit 1
line_289	Line	ORACLE 115 to ORACLEAZ 115	Circuit 1
line_290	Line	ORACLE 115 to S.BRKRCH 115	Circuit 1
line_291	Line	ORME 230 to ANDERSON 230	Circuit 1
line_292	Line	ORME 230 to ANDERSON 230	Circuit 2
line_293	Line	ORME 230 to RUDD 230	Circuit 1
line_294	Line	ORME 230 to RUDD 230	Circuit 2
line_295	Line	PALOVRDE 500 to COLRIVER 500	Circuit 1
line_296	Line	PALOVRDE 500 to DELANY 500	Circuit 1
line_297	Line	PALOVRDE 500 to DEVERS 500	Circuit 1
line_298	Line	PALOVRDE 500 to RUDD 500	Circuit 1
line_299	Line	PALOVRDE 500 to WESTWING 500	Circuit 1
line_300	Line	PALOVRDE 500 to WESTWING 500	Circuit 2
line_301	Line	PANTANO 115 to KARTCHNR 115	Circuit 1
line_302	Line	PANTANO 230 to NEWTUCSN 230	Circuit 1
line_303	Line	PAPAGOBT 230 to KYR-EAST 230	Circuit 1
line_304	Line	PAPAGOBT 230 to PINPKSRP 230	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_305	Line	PARKER 161 to BLYTHE 161	Circuit 1
line_306	Line	PARKER 161 to BOUSE 161	Circuit 1
line_307	Line	PARKER 161 to HEADGATE 161	Circuit 1
line_308	Line	PARKER 161 to PARKERAZ 161	Circuit 1
line_309	Line	PARKER 230 to BLK MESA 230	Circuit 1
line_310	Line	PARKER 230 to EAGLEYE 230	Circuit 1
line_311	Line	PARKER 230 to GENE 230	Circuit 1
line_312	Line	PARKER 230 to HARCUVAR 230	Circuit 1
line_313	Line	PARKER 230 to HAVASU 230	Circuit 1
line_314	Line	PD-MORNC 230 to FRISCO 230	Circuit 1
line_315	Line	PEACOCK 230 to HILLTOP 230	Circuit 1
line_316	Line	PEACOCK 345 to MEAD 345	Circuit 1
line_317	Line	PERK PS2 500 to PERKINPS 500	Circuit 1
line_318	Line	PERKINS 500 to WESTWING 500	Circuit 1
line_319	Line	PHXWAPA 230 to LONE BUT	230 Circuit
line_320	Line	PICACHOW 115 to PICACHAZ 115	Circuit 1
line_321	Line	PICACHOW 115 to RED ROCK	115 Circuit
line_322	Line	PINAL 115 to SILVERT1 115	Circuit 1
line_323	Line	PINAL_C 230 to DBG 230	Circuit 1
line_324	Line	PINAL_C 230 to RANDOLPH 230	Circuit 1
line_325	Line	PINAL_C 500 to ABEL 500	Circuit 1
line_326	Line	PINAL_C 500 to DUKE 500	Circuit 1
line_327	Line	PINAL_C 500 to TORTOLIT 500	Circuit 1
line_328	Line	PINAL_W 500 to DUKE 500	Circuit 1
line_329	Line	PINPK 230 to GAVLINWA 230	Circuit 1
line_330	Line	PINPK 230 to PINPKSRP 230	Circuit 1
line_331	Line	PINPK 230 to PINPKSRP 230	Circuit 2
line_332	Line	PINPKSRP 230 to BRANDOW 230	Circuit 1
line_333	Line	PINPKSRP 230 to BRANDOW 230	Circuit 2
line_334	Line	PINTO PS 345 to FOURCORN 345	Circuit 1
line_335	Line	PPAPS C 230 to PPAPS E 230	Circuit 1
line_336	Line	PPAPS E 230 to PPAPS N 230	Circuit 1
line_337	Line	PPAPS N 230 to OCOTILLO 230	Circuit 1
line_338	Line	PPAPS N 230 to PINPKSRP 230	Circuit 1
line_339	Line	PPAPS N 230 to PINPKSRP 230	Circuit 2
line_340	Line	PPAPS W 230 to PINPK 230	Circuit 1
line_341	Line	PPAPS W 230 to PPAPS C 230	Circuit 1
line_342	Line	PRECHCYN 345 to PNPKAPS 345	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_343	Line	PRESCOTT 115 to BAGDTWN 115	Circuit 1
line_344	Line	PRSCOTWA 230 to PRESCOTT 230	Circuit 1
line_345	Line	PRSCOTWA 230 to RNDVLYTP 230	Circuit 1
line_346	Line	Q044 230 to GILARIVR 230	Circuit 1
line_347	Line	RACEWAY 230 to RACEWYWA 230	Circuit 1
line_348	Line	RACEWYWA 230 to WESTWNGE 230	Circuit 1
line_349	Line	RATTLSNK 115 to TUCSON 115	Circuit 1
line_350	Line	RATTLSNK 115 to TWINPEAK 115	Circuit 1
line_351	Line	RAY 115 to KNOLL 115	Circuit 1
line_352	Line	RAY 115 to SUPERIOR 115	Circuit 1
line_353	Line	REACH 230 to LONEPEAK 230	Circuit 1
line_354	Line	REACH 230 to PPAPS C 230	Circuit 1
line_355	Line	RED ROCK 115 to REDRCKAZ 115	Circuit 1
line_356	Line	RED ROCK 115 to SAG.EAST 115	Circuit 1
line_357	Line	RED TAIL 230 to DOSCONDO 230	Circuit 1
line_358	Line	REFINERY 115 to 842E2.7N 115	Circuit 1
line_359	Line	RNDVLYTP 230 to PEACOCK 230	Circuit 1
line_360	Line	RNDVLYTP 230 to RNDVLYAZ 230	Circuit 1
line_361	Line	ROGERS 230 to ROGSWAPA 230	Circuit 1
line_362	Line	ROGERS 230 to ROGSWAPA 230	Circuit 2
line_363	Line	ROGERS 230 to THUNDRST 230	Circuit 1
line_364	Line	ROGSWAPA 230 to PINPK 230	Circuit 1
line_365	Line	ROGSWAPA 230 to PINPK 230	Circuit 2
line_366	Line	ROGSWAPA 230 to SPKHILTP 230	Circuit 1
line_367	Line	RUDD 230 to PLMVLY 230	Circuit 1
line_368	Line	RUDD 230 to WHITETNK 230	Circuit 1
line_369	Line	S.BRKRCH 115 to SNMANUEL 115	Circuit 1
line_370	Line	SAG.EAST 115 to MARANA 115	Circuit 1
line_371	Line	SAG.EAST 115 to ORACLE 115	Circuit 1
line_372	Line	SAG.EAST 115 to SAG.WEST 115	Circuit 1
line_373	Line	SAG.WEST 115 to ED-5 115	Circuit 1
line_374	Line	SAG.WEST 115 to ED-5B 115	Circuit 1
line_375	Line	SAG.WEST 115 to SNMANUEL 115	Circuit 1
line_376	Line	SAGUARO 230 to MILLIGAN 230	Circuit 1
line_377	Line	SAGUARO 230 to TATMOMLI 230	Circuit 1
line_378	Line	SAGUARO 500 to TORTLIT2 500	Circuit 1
line_379	Line	SAGUARO 500 to TORTOLIT 500	Circuit 1
line_380	Line	SAGUARO 500 to TORTOLIT 500	Circuit 2

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_381	Line	SAHUARIT 230 to BICKNELL 230	Circuit 1
line_382	Line	SANDARIO 115 to BRAWLEY 115	Circuit 1
line_383	Line	SANDARIO 115 to SANDARAZ 115	Circuit 1
line_384	Line	SANTAN 230 to CORBELL 230	Circuit 1
line_385	Line	SANTAN 230 to RS-24 230	Circuit 1
line_386	Line	SANTAN 230 to THUNDRST 230	Circuit 1
line_387	Line	SANXAVER 115 to SANXAVAZ 115	Circuit 1
line_388	Line	SANXAVER 115 to SNYDHILL 115	Circuit 1
line_389	Line	SAN_JUAN 345 to MCKINLEY 345	Circuit 1
line_390	Line	SAN_JUAN 345 to MCKINLEY 345	Circuit 2
line_391	Line	SCHRADER 230 to SANTAN 230	Circuit 1
line_392	Line	SCTWSH 230 to PPAPS W 230	Circuit 1
line_393	Line	SGRLF 500 to CHOLLA 500	Circuit 1
line_394	Line	SHIPROCK 115 to FRUITAP 115	Circuit 1
line_395	Line	SHIPROCK 115 to PRAXAR 115	Circuit 1
line_396	Line	SHIPROCK 345 to FOURCORN 345	Circuit 1
line_397	Line	SHIPROCK 345 to SAN_JUAN 345	Circuit 1
line_398	Line	SIGURDPS 230 to GLENCANY 230	Circuit 1
line_399	Line	SILVERK1 115 to SILVERT1 115	Circuit 1
line_400	Line	SILVERK2 115 to PINTOVLY 115	Circuit 1
line_401	Line	SILVERK2 115 to SUPERIOR 115	Circuit 1
line_402	Line	SILVERKG 230 to GOLDFELD 230	Circuit 1
line_403	Line	SNTAROSA 230 to DBG 230	Circuit 1
line_404	Line	SNTAROSA 230 to TATMOMLI 230	Circuit 1
line_405	Line	SNTAROSA 230 to TESTTRAK 230	Circuit 1
line_406	Line	SNVLY 230 to HASSY AZ 230	Circuit 1
line_407	Line	SNVLY 230 to TRLBY 230	Circuit 1
line_408	Line	SNVLY 230 to TRLBY 230	Circuit 2
line_409	Line	SNVLY 500 to MORGAN 500	Circuit 1
line_410	Line	SNYDHLAZ 115 to SNYDHILL 115	Circuit 1
line_411	Line	SONOITA 115 to VALNCIA 115	Circuit 1
line_412	Line	SONOITA 138 to VALNCIA 138	Circuit 1
line_413	Line	SPKHILTP 230 to COOLIDGE 230	Circuit 1
line_414	Line	SPURLOCK 115 to SUPERIOR 115	Circuit 1
line_415	Line	SUN ARIZ 230 to PINAL_C 230	Circuit 1
line_416	Line	SUPERIOR 115 to TRASK 115	Circuit 1
line_417	Line	SURPRISE 230 to EL SOL 230	Circuit 1
line_418	Line	SURPRISE 230 to WESTWNGW 230	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_419	Line	TESTTRAK 230 to CASAGRND 230	Circuit 1
line_420	Line	THREEPNT 115 to SNDARIO 115	Circuit 1
line_421	Line	THREEPNT 115 to VALEN-SW 115	Circuit 1
line_422	Line	THUNDRST 230 to GOLDFELD 230	Circuit 1
line_423	Line	THUNDRST 230 to GOLDFELD 230	Circuit 2
line_424	Line	TOPOCK 230 to BLK MESA 230	Circuit 1
line_425	Line	TOPOCK 230 to SOPOINT 230	Circuit 1
line_426	Line	TOPOCK 230 to SOPOINT 230	Circuit 2
line_427	Line	TOPOCK 230 to LONGTIN 230	Circuit 1
line_428	Line	TRLBY 230 to TS2 230	Circuit 1
line_429	Line	TS12 230 to SAGUARO 230	Circuit 1
line_430	Line	TS2 230 to PLMVLY 230	Circuit 1
line_431	Line	TS4 230 to JOJOBA 230	Circuit 1
line_432	Line	TS4 230 to PLMVLY 230	Circuit 1
line_433	Line	TUBAC 138 to CANEZ 138	Circuit 1
line_434	Line	TUCSON 115 to DEL BAC 115	Circuit 1
line_435	Line	TUCSON 115 to ORACLE 115	Circuit 1
line_436	Line	TURLY_S 115 to BLANCO 115	Circuit 1
line_437	Line	TWINPEAK 115 to SANDARIO 115	Circuit 1
line_438	Line	TWINPEAK 115 to TWINPKAZ 115	Circuit 1
line_439	Line	VERDE S 230 to VERDE N 230	Circuit 1
line_440	Line	VLYFARMS 115 to ORACLE 115	Circuit 1
line_441	Line	WESTLOOP 115 to GLADETAP 115	Circuit 1
line_442	Line	WESTLOOP 115 to HOGBAK 115	Circuit 1
line_443	Line	WESTLOOP 115 to HOODMESA 115	Circuit 1
line_444	Line	WESTLOOP 115 to MESA FM 115	Circuit 1
line_445	Line	WESTLOOP 115 to PRAXAR 115	Circuit 1
line_446	Line	WESTWING 500 to MORGAN 500	Circuit 1
line_447	Line	WESTWNGW 230 to PINPK 230	Circuit 1
line_448	Line	WESTWNGW 230 to WESTWNGE 230	Circuit 1
line_449	Line	WHTNKAPS 230 to EL SOL 230	Circuit 1
line_450	Line	WHTNKAPS 230 to RUDD 230	Circuit 1
line_451	Line	WILOWLKW 230 to PRESCOTT 230	Circuit 1
line_452	Line	WILOWLKW 230 to WILOWLKE 230	Circuit 1
line_453	Line	WLTNMOHK 161 to DOME TAP 161	Circuit 1
line_454	Line	WLTNMOHK 161 to GILA 161	Circuit 1
line_455	Line	WPHXAPSN 230 to WHTNKAPS 230	Circuit 1
line_456	Line	WPHXAPSS 230 to RUDD 230	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_457	Line	WPHXAPSS 230 to WPHXAPSN 230	Circuit 1
line_458	Line	YAVAPAI 230 to VERDE N 230	Circuit 1
line_459	Line	YAVAPAI 230 to WILOWLKE 230	Circuit 1
line_460	Line	YAVAPAI 500 to WESTWING 500	Circuit 1
line_461	Line	BUCKEYE2 230 to LIBERTY 230	Circuit 1
line_462	Line	Q113EQ2 138 to Q113EQ3 138	Circuit 1
line_463	Line	CEDARMT 500 to YAVAPAI 500	Circuit 1
line_464	Line	BAGDTWN 115 to BAGCAP 115	Circuit 1
line_465	Line	BAGCAP 115 to BAGDAD 115	Circuit 1
line_466	Line	GREENLEE 345 to COPPERVR 345	Circuit 1
line_467	Line	GREENLEE 345 to WILLOW 345	Circuit 1
line_468	Line	GREENLEE 345 to WINCHSTR 345	Circuit 1
line_469	Line	MCKINLEY 345 to SPRINGR 345	Circuit 1
line_470	Line	MCKINLEY 345 to SPRINGR 345	Circuit 2
line_471	Line	PINALWES 345 to SOUTH 345	Circuit 1
line_472	Line	SPRINGR 345 to LUNA 345	Circuit 1
line_473	Line	SPRINGR 345 to CORONADO 345	Circuit 1
line_474	Line	SPRINGR 345 to GREENLEE 345	Circuit 1
line_475	Line	SPRINGR 345 to VAIL2 345	Circuit 1
line_476	Line	TORTOLIT 345 to NLOOP345 345	Circuit 1
line_477	Line	VAIL 345 to SOUTH 345	Circuit 1
line_478	Line	WESTWING 345 to PINALWES 345	Circuit 1
line_479	Line	WILLOW 345 to BOWIE 345	Circuit 1
line_480	Line	WILLOW 345 to BOWIE 345	Circuit 2
line_481	Line	WINCHSTR 345 to VAIL 345	Circuit 1
line_482	Line	WINCHSTR 345 to WILLOW 345	Circuit 1
line_483	Line	CANOARCH 138 to CLEAR 138	Circuit 1
line_484	Line	CIENEGA 138 to S.TRAIL 138	Circuit 1
line_485	Line	CORONA 138 to IRV_RING 138	Circuit 1
line_486	Line	CORONA 138 to SOUTH 138	Circuit 1
line_487	Line	CRYCROFT 138 to NE.LOOP 138	Circuit 1
line_488	Line	CYPRUS 138 to CLEAR 138	Circuit 1
line_489	Line	DELCERRO 138 to WESTINA 138	Circuit 1
line_490	Line	DMP 138 to ANKLAM 138	Circuit 1
line_491	Line	DMP 138 to N. LOOP 138	Circuit 1
line_492	Line	DMP 138 to NE.LOOP 138	Circuit 1
line_493	Line	DMP 138 to NL. EXP 138	Circuit 1
line_494	Line	DMP 138 to SN.CRUZ 138	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_495	Line	DMP 138 to TUCSON 138	Circuit 1
line_496	Line	DREXEL 138 to IRVNGTN 138	Circuit 1
line_497	Line	DREXEL 138 to MIDVALE 138	Circuit 1
line_498	Line	E. LOOP 138 to HARRISON 138	Circuit 1
line_499	Line	E. LOOP 138 to NE.LOOP 138	Circuit 1
line_500	Line	E. LOOP 138 to PANTANO 138	Circuit 1
line_501	Line	E. LOOP 138 to ROBERTS 138	Circuit 1
line_502	Line	GREENVLY 138 to CANOARCH 138	Circuit 1
line_503	Line	HARTT 138 to GREENVLY 138	Circuit 1
line_504	Line	IRVNGTN 138 to KINO 138	Circuit 1
line_505	Line	IRVNGTN 138 to TECHPARK 138	Circuit 1
line_506	Line	IRVNGTN 138 to TUCSON 138	Circuit 1
line_507	Line	IRVNGTN 138 to VAIL 138	Circuit 2
line_508	Line	IRV_RING 138 to SOUTH 138	Circuit 1
line_509	Line	LOSREALS 138 to VAIL 138	Circuit 1
line_510	Line	MIDVALE 138 to MEDINA 138	Circuit 1
line_511	Line	MIDVALE 138 to SPNCER 138	Circuit 1
line_512	Line	N. LOOP 138 to NL. EXP 138	Circuit 1
line_513	Line	N. LOOP 138 to RANVISTO 138	Circuit 1
line_514	Line	NE.LOOP 138 to NELP_SVC 138	Circuit 1
line_515	Line	NE.LOOP 138 to RILLITO 138	Circuit 1
line_516	Line	NL. EXP 138 to MARANA 138	Circuit 1
line_517	Line	NL. EXP 138 to NARANJA 138	Circuit 1
line_518	Line	NL. EXP 138 to RILLITO 138	Circuit 1
line_519	Line	NL. EXP 138 to WESTINA 138	Circuit 1
line_520	Line	ORNGROVE 138 to EASTINA 138	Circuit 1
line_521	Line	ORNGROVE 138 to LACANADA 138	Circuit 1
line_522	Line	ORNGROVE 138 to RILLITO 138	Circuit 1
line_523	Line	PANTANO 138 to LOSREALS 138	Circuit 1
line_524	Line	RANVISTO 138 to LACANADA 138	Circuit 1
line_525	Line	RANVISTO 138 to NARANJA 138	Circuit 1
line_526	Line	RAYTHEON 138 to MEDINA 138	Circuit 1
line_527	Line	RBWILMOT 138 to IRVNGTN 138	Circuit 1
line_528	Line	RBWILMOT 138 to VAIL 138	Circuit 1
line_529	Line	RILLITO 138 to LACANADA 138	Circuit 1
line_530	Line	ROBERTS 138 to HARRISON 138	Circuit 1
line_531	Line	S.TRAIL 138 to ROBERTS 138	Circuit 1
line_532	Line	SN.CRUZ 138 to ANKLAM 138	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_533	Line	SN.CRUZ 138 to IRVNGTN 138	Circuit 1
line_534	Line	SNYDER 138 to CRYCROFT 138	Circuit 1
line_535	Line	SNYDER 138 to E. LOOP 138	Circuit 1
line_536	Line	SNYDER 138 to NE.LOOP 138	Circuit 1
line_537	Line	SOUTH 138 to ASARCO 138	Circuit 1
line_538	Line	SOUTH 138 to CLEAR 138	Circuit 1
line_539	Line	SOUTH 138 to CYPRUS 138	Circuit 1
line_540	Line	SOUTH 138 to GREENVLY 138	Circuit 1
line_541	Line	SOUTH 138 to MEDINA 138	Circuit 1
line_542	Line	SOUTH 138 to MIDVALE 138	Circuit 1
line_543	Line	SOUTH 138 to RAYTHEON 138	Circuit 1
line_544	Line	SOUTH 138 to TORO 138	Circuit 1
line_545	Line	SPNCER 138 to MEDINA 138	Circuit 1
line_546	Line	TECHPARK 138 to VAIL 138	Circuit 1
line_547	Line	TORO 138 to GREENVLY 138	Circuit 1
line_548	Line	TORO 138 to HARTT 138	Circuit 1
line_549	Line	TORO 138 to ROSEMONT 138	Circuit 1
line_550	Line	TORTOLIT 138 to MARANA 138	Circuit 1
line_551	Line	TORTOLIT 138 to N. LOOP 138	Circuit 3
line_552	Line	TORTOLIT 138 to N. LOOP 138	Circuit 4
line_553	Line	TORTOLIT 138 to NARANJA 138	Circuit 1
line_554	Line	TORTOLIT 138 to NL. EXP 138	Circuit 1
line_555	Line	TORTOLIT 138 to NL. EXP 138	Circuit 2
line_556	Line	TORTOLIT 138 to NL. EXP 138	Circuit 3
line_557	Line	TORTOLIT 138 to NL. EXP 138	Circuit 4
line_558	Line	TORTOLIT 138 to RANVISTO 138	Circuit 1
line_559	Line	TUCSON 138 to DELCERRO 138	Circuit 1
line_560	Line	TUCSON 138 to KINO 138	Circuit 1
line_561	Line	TWNTYSEC 138 to E. LOOP 138	Circuit 1
line_562	Line	TWNTYSEC 138 to IRVNGTN 138	Circuit 1
line_563	Line	UA MED 138 to KINO 138	Circuit 1
line_564	Line	UA MED 138 to TUCSON 138	Circuit 1
line_565	Line	VAIL 138 to NOGALES 138	Circuit 1
line_566	Line	VAIL 138 to CIENEGA 138	Circuit 1
line_567	Line	VAIL 138 to FT.HUACH 138	Circuit 1
line_568	Line	MACHO_SPRNGS 345 to SPRINGR 345	Circuit 1
line_569	Line	Q043B1 500 to HDWSH 500	Circuit 1
line_570	Line	Q043B2 500 to HDWSH 500	Circuit 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
line_571	Line	HASSYAMP 500 to PALOVRDE 500	Circuit 3
line_572	Line	MESQUITE 230 to MESSOLAR 230	Circuit 2
line_573	Line	MESQUITE 230 to MESSOLAR 230	Circuit 1
tran_574	Tran	SAN_JUAN 230 to HOGBAK 115	Circuit 1
tran_575	Tran	GILARIVR 500 to GILARIVR 230	Circuit 1
tran_576	Tran	SNVLY 500 to SNVLY 230	Circuit 1SNVLYT1T
tran_577	Tran	SNVLY 500 to SNVLY 230	Circuit 2SNVLYT2T
tran_578	Tran	PNPKAPS 345 to PPAPS C 230	Circuit 1PNPK
tran_579	Tran	PNPKAPS 345 to PPAPS N 230	Circuit 2PNPK
tran_580	Tran	PNPKAPS 345 to PPAPS E 230	Circuit 3PNPK
tran_581	Tran	SAGUARO 230 to SAG.WEST 115	Circuit 1SAG
tran_582	Tran	KYRENE 500 to KYR-EAST 230	Circuit 7KYRENE7
tran_583	Tran	PINAL_C 500 to PINAL_C 230	Circuit 1
tran_584	Tran	PINAL_C 500 to PINAL_C 230	Circuit 2
tran_585	Tran	PERKINS 500 to PERK PS1 500	Circuit 1
tran_586	Tran	PERKINS 500 to PERK PS2 500	Circuit 1
tran_587	Tran	SILVERKG 500 to SILVERKG 230	Circuit 1SILVERKG
tran_588	Tran	BROWNING 500 to BROWNING 230	Circuit 1ABROWNIN1
tran_589	Tran	BROWNING 500 to BROWNING 230	Circuit 1BBROWNIN2
tran_590	Tran	RUDD 500 to RUDD 230	Circuit 1ARUDD1
tran_591	Tran	RUDD 500 to RUDD 230	Circuit 1BRUDD2
tran_592	Tran	RUDD 500 to RUDD 230	Circuit 3ARUDD3
tran_593	Tran	RUDD 500 to RUDD 230	Circuit 3B
tran_594	Tran	MESQUITE 500 to MESQUITE 230	Circuit 1
tran_595	Tran	GOLDFELD 230 to GOLDFELD 115	Circuit 1
tran_596	Tran	GOLDFELD 230 to GOLDFELD 115	Circuit 2
tran_597	Tran	SILVERKG 230 to SILVERK1 115	Circuit 1
tran_598	Tran	SILVERKG 230 to SILVERK2 115	Circuit 1
tran_599	Tran	COPPERVR 345 to COPPERVR 230	Circuit 1
tran_600	Tran	COPPERVR 345 to COPPERVR 230	Circuit 2
tran_601	Tran	MEAD S 230 to MEAD 287	Circuit 1
tran_602	Tran	MEAD 345 to MEAD N 230	Circuit 1
tran_603	Tran	MEAD 500 to MEAD N 230	Circuit 1
tran_604	Tran	MEAD 500 to MEAD N 230	Circuit 2
tran_605	Tran	PARKER 161 to PARKER 230	Circuit 1
tran_606	Tran	PARKER 161 to PARKER 230	Circuit 2
tran_607	Tran	COOLIDGE 230 to COOLIDGE 115	Circuit 1
tran_608	Tran	COOLIDGE 230 to COOLIDGE 115	Circuit 2

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
tran_609	Tran	LIBERTY 345 to LIBTYPHS 230	Circuit 1
tran_610	Tran	NGL-W 230 to N.GILA 500	Circuit 1
tran_611	Tran	CASAGRND 230 to CASAGRND 115	Circuit 1
tran_612	Tran	PEACOCK 345 to PEACOCK 230	Circuit 1
tran_613	Tran	GLEN PS 230 to GLENCANY 230	Circuit 1
tran_614	Tran	GLENCANY 345 to GLENCANY 230	Circuit 1
tran_615	Tran	GLENCANY 345 to GLENCANY 230	Circuit 2
tran_616	Tran	PINPKBRB 345 to PINPK 230	Circuit 1
tran_617	Tran	PINPKBRB 345 to PINPK 230	Circuit 2
tran_618	Tran	PINPKBRB 345 to PINPK 230	Circuit 3
tran_619	Tran	SHIP PS 230 to SHIPROCK 230	Circuit 1
tran_620	Tran	SHIPROCK 230 to SHIPROCK 115	Circuit 1
tran_621	Tran	SHIPROCK 345 to SHIPROCK 230	Circuit 1SHKU1AT
tran_622	Tran	GREEN-SW 345 to GREEN-SW 230	Circuit 1
tran_623	Tran	BICKNELL 345 to BICKNELL 230	Circuit 1
tran_624	Tran	APACHE 230 to APACHE 115	Circuit 1
tran_625	Tran	APACHE 230 to APACHE 115	Circuit 2
tran_626	Tran	BICKNELL 230 to BICKNELL 115	Circuit 1
tran_627	Tran	BICKNELL 230 to BICKNELL 115	Circuit 2
tran_628	Tran	PANTANO 230 to PANTANO 115	Circuit 1
tran_629	Tran	GALLEGOS 230 to GALLEGOS 115	Circuit 1
tran_630	Tran	LIBTYPHS 230 to LIBERTY 230	Circuit 2
tran_631	Tran	N.GILA 500 to N.GILA 230	Circuit 1N.GIL10T
tran_632	Tran	SNMANUEL 115 to SNMANUEL 100	Circuit 1
tran_633	Tran	SAGUARO 500 to SAG.EAST 115	Circuit 1SAGUAR7T
tran_634	Tran	SAGUARO 500 to SAG.WEST 115	Circuit 1SAGUAR4T
tran_635	Tran	SAGUARO 230 to SAG.EAST 115	Circuit 1SAG
tran_636	Tran	PNPKAPS 500 to PPAPS E 230	Circuit 1PP
tran_637	Tran	PNPKAPS 500 to PPAPS N 230	Circuit 1PP
tran_638	Tran	PNPKAPS 500 to PPAPS W 230	Circuit 1PP
tran_639	Tran	MORGAN 500 to RACEWAY 230	Circuit 1MOR1
tran_640	Tran	WESTWING 500 to WESTWNGE 230	Circuit 1WESTWG
tran_641	Tran	WESTWING 500 to WESTWNGW 230	Circuit 1WESTWG
tran_642	Tran	WESTWING 500 to WESTWNGW 230	Circuit 2WESTWG
tran_643	Tran	YAVAPAI 500 to YAVAPAI 230	Circuit 1YAVAP
tran_644	Tran	YAVAPAI 500 to YAVAPAI 230	Circuit 2YAVAP
tran_645	Tran	FOURCORN 500 to FOURCORN 345	Circuit 14C
tran_646	Tran	FOURCORN 345 to FOURCORN 230	Circuit 1FOURCN4T

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
tran_647	Tran	FOURCORN 345 to FOURCORN 230	Circuit 2FOURCN8T
tran_648	Tran	CHOLLA 500 to CHOLLA 345	Circuit 1CHOLLA3T
tran_649	Tran	CHOLLA 500 to CHOLLA 345	Circuit 2CHOLLA6T
tran_650	Tran	CHOLLA 345 to CHOLLA 230	Circuit 1CHOLLA7T
tran_651	Tran	PRESCOTT 230 to PRESCOTT 115	Circuit 1PRESCT1T
tran_652	Tran	PRESCOTT 230 to PRESCOTT 115	Circuit 2PRESCT2T
tran_653	Tran	KYRENE 500 to KYR-WEST 230	Circuit 6KYRENE6
tran_654	Tran	KYRENE 500 to KYR-EAST 230	Circuit 8KYRENE8
tran_655	Tran	ABEL 500 to ABEL 230	Circuit 1
tran_656	Tran	ABEL 500 to ABEL 230	Circuit 2
tran_657	Tran	DUKE 500 to TESTTRAK 230	Circuit 1
tran_658	Tran	MESQUIT2 500 to MESQUITE 230	Circuit 2
tran_659	Tran	Q113EQ3 138 to CEDARMT 500	Circuit 1
tran_660	Tran	CORONADO 500 to CORONADO 345	Circuit 1
tran_661	Tran	CORONADO 500 to CORONADO 345	Circuit 2
tran_662	Tran	PINAL_W 500 to PINALWES 345	Circuit 1
tran_663	Tran	TORTOLIT 500 to TORTOLIT 345	Circuit 1
tran_664	Tran	WESTWING 500 to WESTWING 345	Circuit 1
tran_665	Tran	MCKINLEY 345 to YAHTAHEY 115	Circuit 1
tran_666	Tran	SOUTH 345 to SOUTH 138	Circuit 1SOUTH2
tran_667	Tran	SOUTH 345 to SOUTH 138	Circuit 2SOUTH3
tran_668	Tran	VAIL 345 to VAIL 138	Circuit 1VAIL
tran_669	Tran	VAIL 345 to VAIL 138	Circuit 3VAIL
tran_670	Tran	VAIL2 345 to VAIL 138	Circuit 1
tran_671	Tran	VAIL2 345 to VAIL 138	Circuit 2
tran_672	Tran	WINCHSTR 345 to WINCHSTR 230	Circuit 1
tran_673	Tran	IRVMID3 138 to IRVNGTN 138	Circuit 1
tran_674	Tran	IRVMID4 138 to IRVNGTN 138	Circuit 1
tran_675	Tran	SPNCER 138 to SPNCER 115	Circuit 1SPNCER
tran_676	Tran	TORTOLIT 138 to SAG.EAST 115	Circuit 1
tran_677	Tran	TORTOLIT 138 to SAG.WEST 115	Circuit 1
tran_678	Tran	TORTOLIT 138 to TORTLIT2 500	Circuit 1
tran_679	Tran	TORTOLIT 138 to TORTOLIT 500	Circuit 1
tran_680	Tran	TORTOLIT 138 to TORTOLIT 500	Circuit 2
tran_681	Tran	TORTOLIT 138 to TORTOLIT 500	Circuit 3
tran_682	Tran	TORTOLIT 138 to TORTOLIT 500	Circuit 4
tran_683	Tran	RUDD 500 to RUDD 230	Circuit 3SRUDD
gen_684	Gen	CORONAD1	Unit ID 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
gen_685	Gen	CORONAD2	Unit ID 1
gen_686	Gen	KYRENE 2	Unit ID 1
gen_687	Gen	KYRENE 4	Unit ID 1
gen_688	Gen	KYRENE 6	Unit ID 1
gen_689	Gen	NAVAJO 1	Unit ID 1
gen_690	Gen	NAVAJO 2	Unit ID 1
gen_691	Gen	NAVAJO 3	Unit ID 1
gen_692	Gen	AGUAFR 5	Unit ID 1
gen_693	Gen	AGUAFR 6	Unit ID 2
gen_694	Gen	AGUAFR 4	Unit ID 1
gen_695	Gen	AGUAFR 3	Unit ID 1
gen_696	Gen	AGUAFR 1	Unit ID 1
gen_697	Gen	AGUAFR 2	Unit ID 2
gen_698	Gen	SANTAN 1	Unit ID 1
gen_699	Gen	SANTAN 2	Unit ID 1
gen_700	Gen	HRSMS4	Unit ID 1
gen_701	Gen	ABEL G1	Unit ID 1
gen_702	Gen	ABEL G2	Unit ID 1
gen_703	Gen	ABEL G3	Unit ID 1
gen_704	Gen	ABEL G4	Unit ID 1
gen_705	Gen	ABEL G5	Unit ID 1
gen_706	Gen	ABEL G6	Unit ID 1
gen_707	Gen	ABEL G7	Unit ID 1
gen_708	Gen	ABEL G8	Unit ID 1
gen_709	Gen	ABEL G9	Unit ID 1
gen_710	Gen	KYREN 7S	Unit ID 1
gen_711	Gen	ARL-CT1	Unit ID 1
gen_712	Gen	ARL-CT2	Unit ID 1
gen_713	Gen	ARL-ST1	Unit ID 1
gen_714	Gen	HGC-CT1	Unit ID 1
gen_715	Gen	HGC-ST1	Unit ID 1
gen_716	Gen	HGC-CT2	Unit ID 1
gen_717	Gen	HGC-ST2	Unit ID 1
gen_718	Gen	HGC-CT3	Unit ID 1
gen_719	Gen	HGC-ST3	Unit ID 1
gen_720	Gen	MES-CT1	Unit ID 1
gen_721	Gen	MES-CT2	Unit ID 1
gen_722	Gen	MES-ST1	Unit ID 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
gen_723	Gen	MES-CT3	Unit ID 1
gen_724	Gen	MES-CT4	Unit ID 1
gen_725	Gen	MES-ST2	Unit ID 1
gen_726	Gen	CHOLLA	Unit ID 1
gen_727	Gen	CHOLLA2	Unit ID 1
gen_728	Gen	CHOLLA3	Unit ID 1
gen_729	Gen	CHOLLA4	Unit ID 1
gen_730	Gen	FCNGEN 1	Unit ID 1
gen_731	Gen	FCNGEN 2	Unit ID 1
gen_732	Gen	FCNGEN 3	Unit ID 1
gen_733	Gen	OCOTGT2	Unit ID 1
gen_734	Gen	PALOVRD1	Unit ID 1
gen_735	Gen	PALOVRD2	Unit ID 1
gen_736	Gen	PALOVRD3	Unit ID 1
gen_737	Gen	SAG. CT1	Unit ID 1
gen_738	Gen	SAG. CT2	Unit ID 1
gen_739	Gen	SAGUARO1	Unit ID 1
gen_740	Gen	SAGUARO2	Unit ID 1
gen_741	Gen	WPHX CC1	Unit ID 1
gen_742	Gen	WPHX CC2	Unit ID 1
gen_743	Gen	WPHX CC3	Unit ID 1
gen_744	Gen	WPCC5CT1	Unit ID 1
gen_745	Gen	WPCC5CT2	Unit ID 1
gen_746	Gen	WPCC5ST1	Unit ID 1
gen_747	Gen	WPCC4CT1	Unit ID 1
gen_748	Gen	RED-CT1	Unit ID 1
gen_749	Gen	RED-CT2	Unit ID 1
gen_750	Gen	GIL-CT1	Unit ID 1
gen_751	Gen	GIL-CT2	Unit ID 1
gen_752	Gen	GIL-ST1	Unit ID 1
gen_753	Gen	GIL-CT3	Unit ID 1
gen_754	Gen	GIL-CT4	Unit ID 1
gen_755	Gen	GIL-ST2	Unit ID 1
gen_756	Gen	GIL-CT5	Unit ID 1
gen_757	Gen	GIL-CT6	Unit ID 1
gen_758	Gen	GIL-ST3	Unit ID 1
gen_759	Gen	GIL-CT7	Unit ID 1
gen_760	Gen	GIL-CT8	Unit ID 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
gen_761	Gen	GIL-ST4	Unit ID 1
gen_762	Gen	SAG. CT3	Unit ID 1
gen_763	Gen	RED-CT3	Unit ID 1
gen_764	Gen	RED-CT4	Unit ID 1
gen_765	Gen	RED-ST1	Unit ID 1
gen_766	Gen	RED-ST2	Unit ID 1
gen_767	Gen	KYREN 7A	Unit ID 1
gen_768	Gen	SANTN 5S	Unit ID 1
gen_769	Gen	SANTN 5A	Unit ID 1
gen_770	Gen	SANTN 5B	Unit ID 1
gen_771	Gen	SANTN 6A	Unit ID 1
gen_772	Gen	SANTN 6S	Unit ID 1
gen_773	Gen	HOOVERA3	Unit ID 1
gen_774	Gen	HOOVERA4	Unit ID 1
gen_775	Gen	HOOVERA5	Unit ID 1
gen_776	Gen	HOOVERA6	Unit ID 1
gen_777	Gen	HOOVERA7	Unit ID 1
gen_778	Gen	HOVRA1A2	Unit ID A1
gen_779	Gen	HOVRA1A2	Unit ID A2
gen_780	Gen	HOVRA8A9	Unit ID A8
gen_781	Gen	HOVRA8A9	Unit ID A9
gen_782	Gen	HOVRN1N2	Unit ID N1
gen_783	Gen	HOVRN1N2	Unit ID N2
gen_784	Gen	HOVRN3N4	Unit ID N3
gen_785	Gen	HOVRN3N4	Unit ID N4
gen_786	Gen	HOVRN5N6	Unit ID N5
gen_787	Gen	HOVRN5N6	Unit ID N6
gen_788	Gen	HOVRN7N8	Unit ID N7
gen_789	Gen	HOVRN7N8	Unit ID N8
gen_790	Gen	GLENC1-2	Unit ID 1
gen_791	Gen	GLENC1-2	Unit ID 2
gen_792	Gen	GLENC3-4	Unit ID 3
gen_793	Gen	GLENC3-4	Unit ID 4
gen_794	Gen	GLENC5-6	Unit ID 5
gen_795	Gen	GLENC5-6	Unit ID 6
gen_796	Gen	GLENC7-8	Unit ID 7
gen_797	Gen	GLENC7-8	Unit ID 8
gen_798	Gen	SOPOINT1	Unit ID 1

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
gen_799	Gen	SOPOINT2	Unit ID 2
gen_800	Gen	SOPOINT3	Unit ID 3
gen_801	Gen	GRIFFTH1	Unit ID 1
gen_802	Gen	GRIFFTH2	Unit ID 2
gen_803	Gen	GRIFFTH3	Unit ID 3
gen_804	Gen	HAVASU12	Unit ID 1
gen_805	Gen	HAVASU12	Unit ID 2
gen_806	Gen	DBG-CT1	Unit ID 1
gen_807	Gen	DBG-CT2	Unit ID 1
gen_808	Gen	DBG-ST1	Unit ID 1
gen_809	Gen	CPGS 1	Unit ID 1
gen_810	Gen	CPGS 2	Unit ID 1
gen_811	Gen	CPGS 3	Unit ID 1
gen_812	Gen	CPGS 4	Unit ID 1
gen_813	Gen	CPGS 5	Unit ID 1
gen_814	Gen	CPGS 6	Unit ID 1
gen_815	Gen	CPGS 7	Unit ID 1
gen_816	Gen	CPGS 8	Unit ID 1
gen_817	Gen	CPGS 9	Unit ID 1
gen_818	Gen	CPGS 10	Unit ID 1
gen_819	Gen	CPGS 11	Unit ID 1
gen_820	Gen	CPGS 12	Unit ID 1
gen_821	Gen	SUN G1	Unit ID 1
gen_822	Gen	SUN G2	Unit ID 2
gen_823	Gen	SUN G3	Unit ID 3
gen_824	Gen	SUN G4	Unit ID 4
gen_825	Gen	SUN G5	Unit ID 5
gen_826	Gen	SUN G6	Unit ID 6
gen_827	Gen	SUN G7	Unit ID 7
gen_828	Gen	SUN G8	Unit ID 8
gen_829	Gen	SUN G9	Unit ID 9
gen_830	Gen	SUN G10	Unit ID 10
gen_831	Gen	BLKMTN1	Unit ID
gen_832	Gen	BLKMTN2	Unit ID
gen_833	Gen	APACHCT3	Unit ID
gen_834	Gen	APACHCT4	Unit ID
gen_835	Gen	APACHST1	Unit ID
gen_836	Gen	APACHST2	Unit ID

2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
gen_837	Gen	APACHST3	Unit ID
gen_838	Gen	VALNCIA2	Unit ID
gen_839	Gen	BLUFFVW	Unit ID
gen_840	Gen	Q044STG1	Unit ID
gen_841	Gen	Q044STG2	Unit ID
gen_842	Gen	OCOTGT1	Unit ID
gen_843	Gen	OCOTST1	Unit ID
gen_844	Gen	OCOTST2	Unit ID
gen_845	Gen	WPHX GT1	Unit ID 1
gen_846	Gen	WPHX GT2	Unit ID 1
gen_847	Gen	FAIRVW11	Unit ID
gen_848	Gen	YUCCAGEN	Unit ID
gen_849	Gen	YUCCACT6	Unit ID
gen_850	Gen	YUCCACT5	Unit ID
gen_851	Gen	YUCCACT4	Unit ID
gen_852	Gen	YUCCACT3	Unit ID
gen_853	Gen	YCACT1	Unit ID
gen_854	Gen	YCAST1	Unit ID
gen_855	Gen	ABITIBI	Unit ID
gen_856	Gen	QUAIL G1	Unit ID 1
gen_857	Gen	QUAIL G2	Unit ID 1
gen_858	Gen	OLIVE G	Unit ID 1
gen_859	Gen	CROSSHYD	Unit ID
gen_860	Gen	KYRENE 5	Unit ID 1
gen_861	Gen	SANTAN 3	Unit ID 1
gen_862	Gen	SANTAN 4	Unit ID 1
gen_863	Gen	FCNGN4CC	Unit ID H
gen_864	Gen	FCNGN4CC	Unit ID L
gen_865	Gen	FCNGN5CC	Unit ID H
gen_866	Gen	FCNGN5CC	Unit ID L
gen_867	Gen	Q113	Unit ID 1
gen_868	Gen	DARBY	Unit ID 1
gen_869	Gen	BOWIE_G1	Unit ID 1
gen_870	Gen	BOWIE_G2	Unit ID 1
gen_871	Gen	BOWIE_G3	Unit ID 1
gen_872	Gen	BOWIE_G4	Unit ID 1
gen_873	Gen	BOWIE_S1	Unit ID 1
gen_874	Gen	BOWIE_S2	Unit ID 1

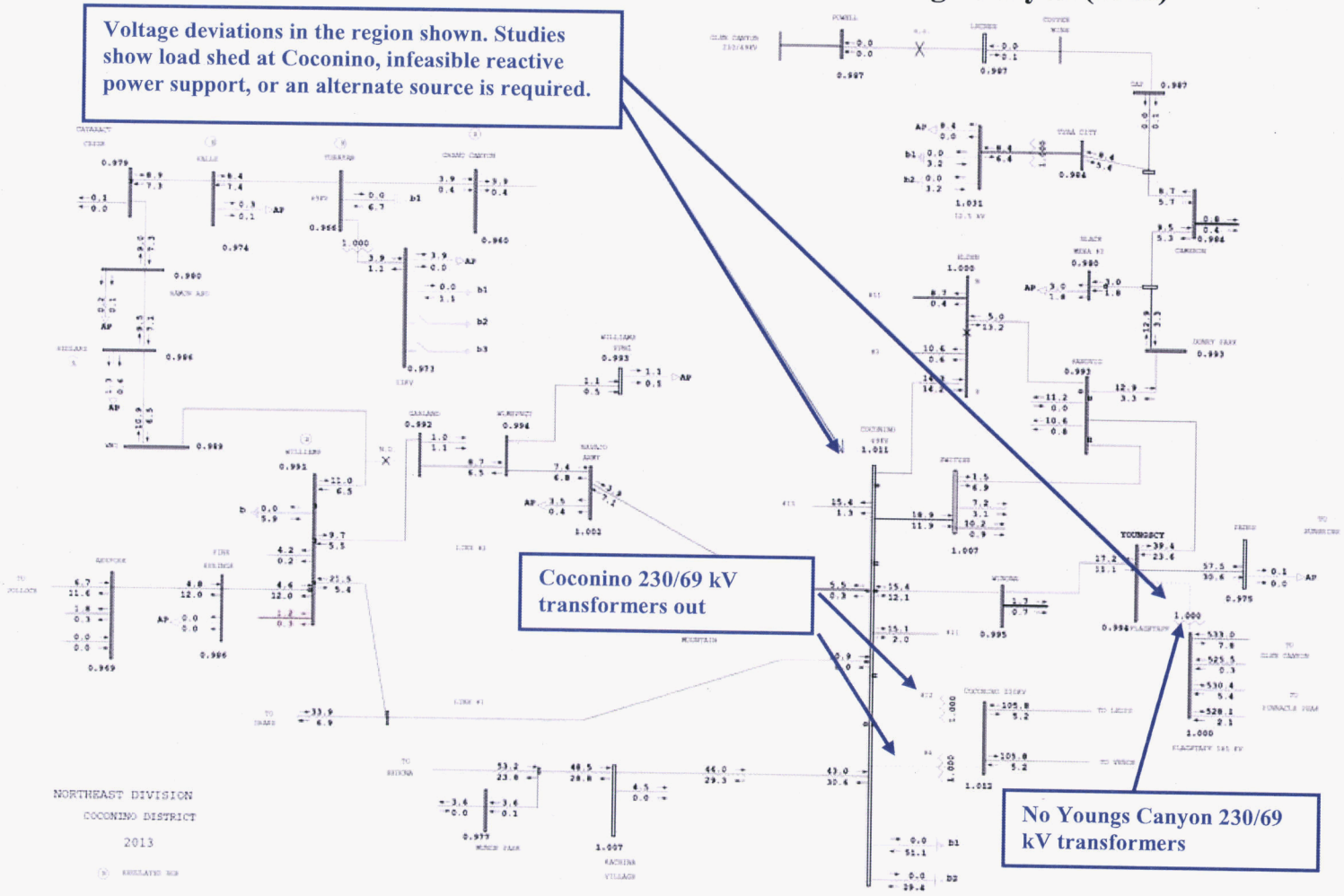
2013 Single Contingency List (Category B)

Outage Number	Type	Contingency	Circuit Number
gen_875	Gen	DMPCCT#1	Unit ID 1
gen_876	Gen	DMPCCT#2	Unit ID 1
gen_877	Gen	DMPCCT#3	Unit ID 1
gen_878	Gen	MACHOSPRNGS1	Unit ID 1
gen_879	Gen	NLOOPCT	Unit ID 3
gen_880	Gen	NLOOPCT	Unit ID 4
gen_881	Gen	SPR GEN1	Unit ID 1
gen_882	Gen	SPR GEN2	Unit ID 1
gen_883	Gen	SPR GEN3	Unit ID 1
gen_884	Gen	SPR GEN4	Unit ID 1
gen_885	Gen	SUNDTGE1	Unit ID 1
gen_886	Gen	SUNDTGE2	Unit ID 1
gen_887	Gen	SUNDTGE3	Unit ID 1
gen_888	Gen	SUNDTGE4	Unit ID 1
gen_889	Gen	NELP_SVC	Unit ID SV
gen_890	Gen	Q43_GEN1	Unit ID 1
gen_891	Gen	Q43_GEN2	Unit ID 2
gen_892	Gen	COL1FDR	Unit ID 1
gen_893	Gen	COL2FDR	Unit ID 1
gen_894	Gen	COL3FDR	Unit ID 1
gen_895	Gen	COL4FDR	Unit ID 1
gen_896	Gen	COL5FDR	Unit ID 1
gen_897	Gen	COL6FDR	Unit ID 1
gen_898	Gen	COL7FDR	Unit ID 1
gen_899	Gen	MERIDIAN	Unit ID 1

APPENDIX B

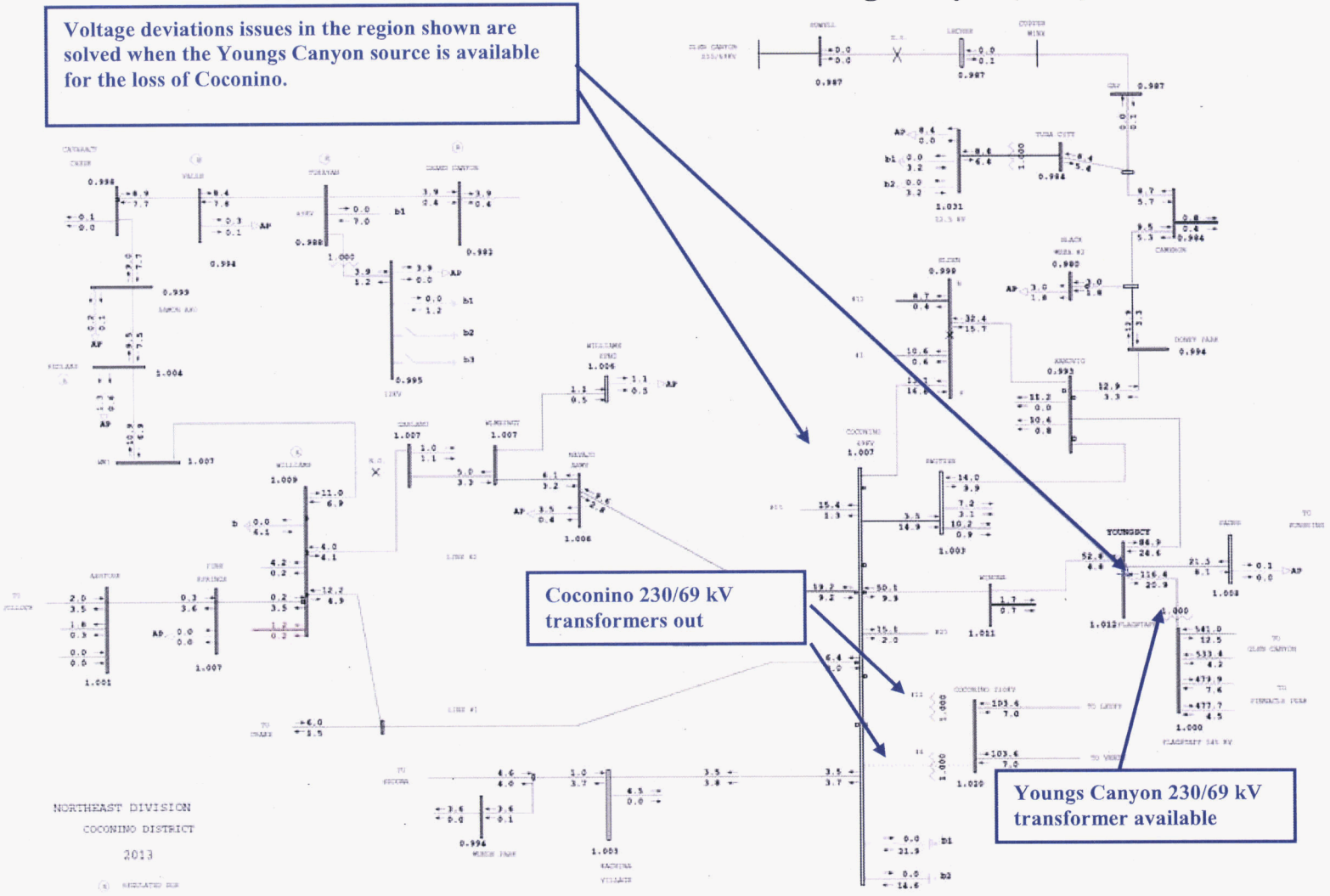
Power Flow Map

Loss of Coconino 230/69kV Substation without Youngs Canyon (2013)

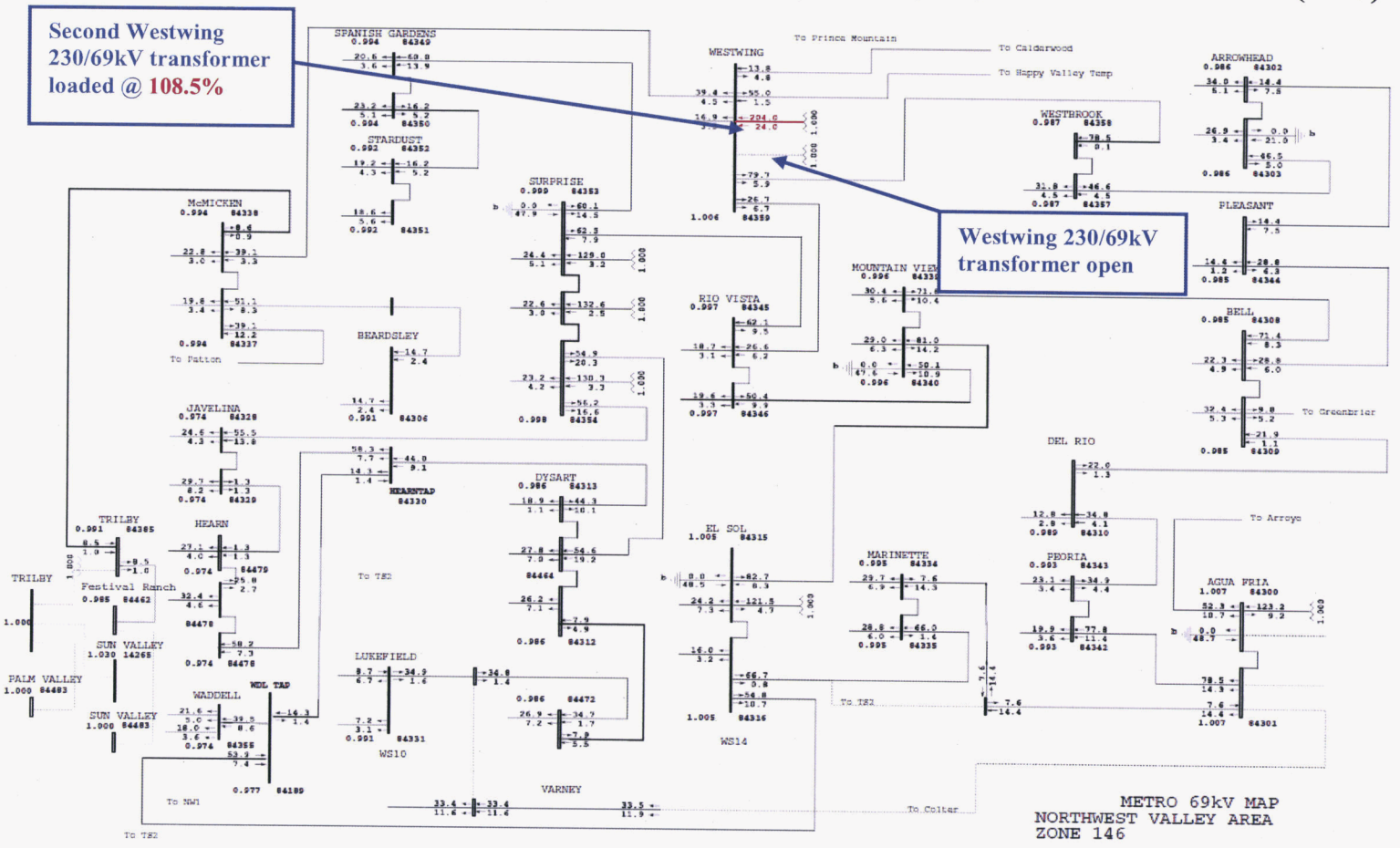


Loss of Coconino 230/69kV Substation with Youngs Canyon (2013)

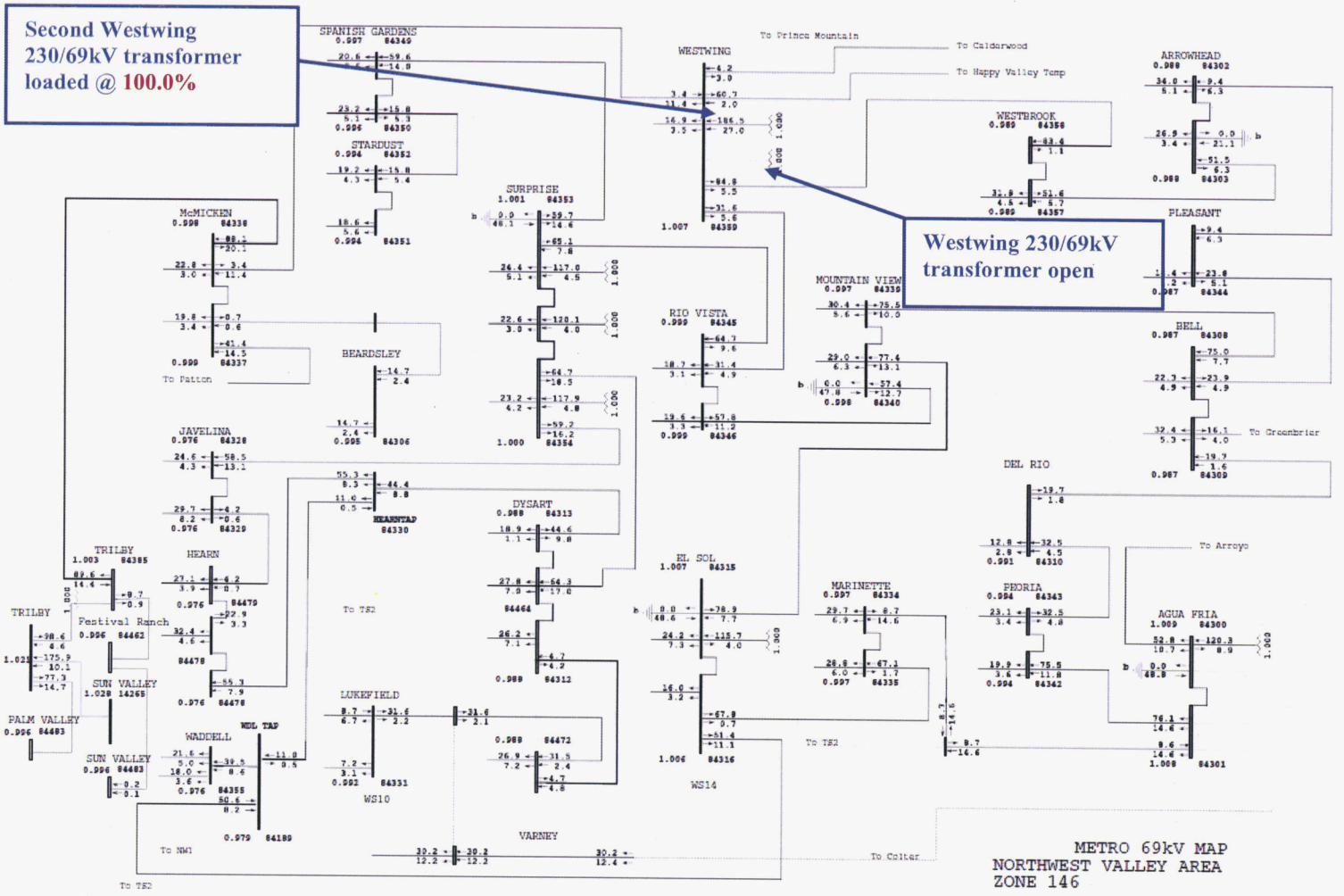
Voltage deviations issues in the region shown are solved when the Youngs Canyon source is available for the loss of Coconino.



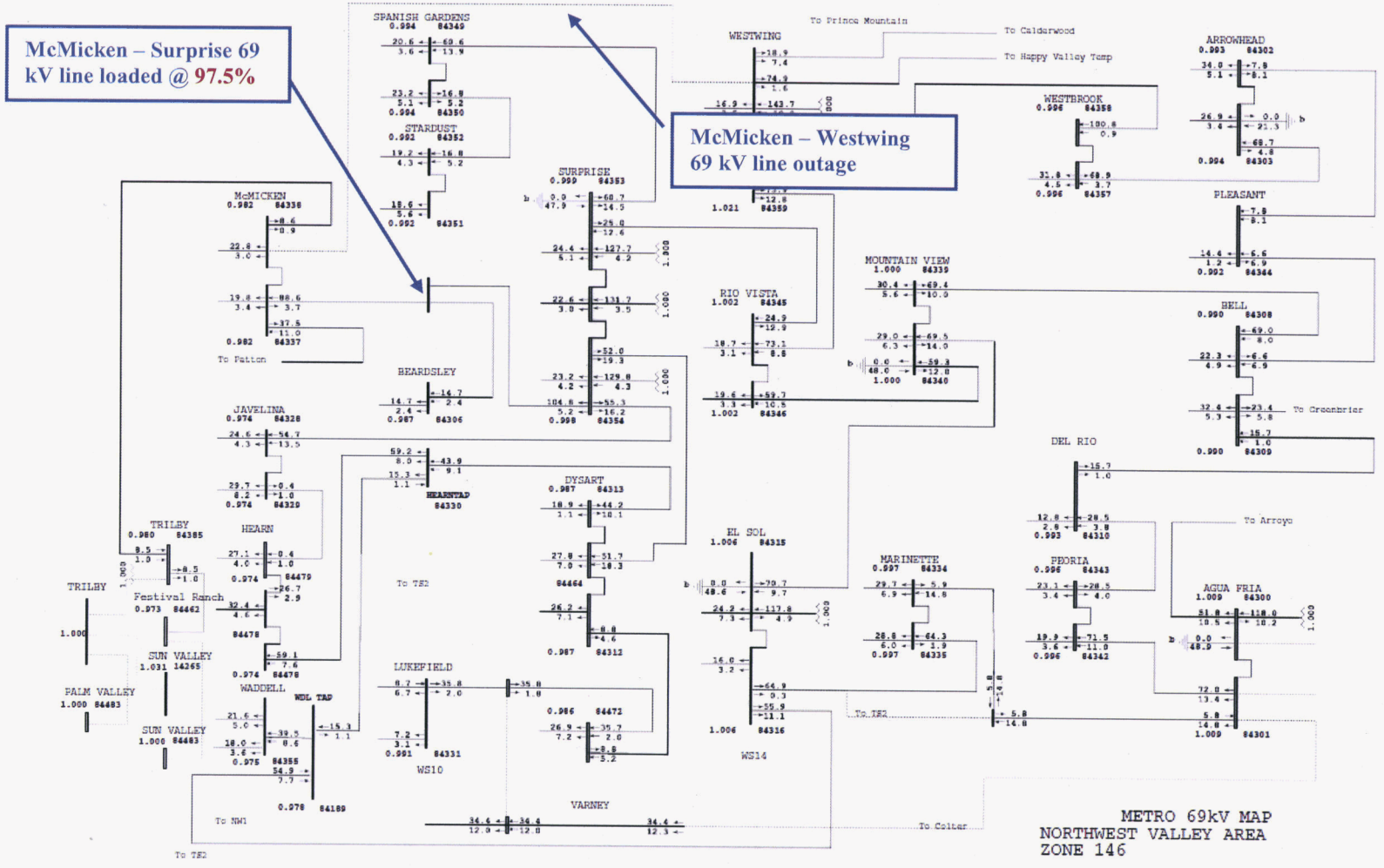
Westwing 230/69kV Transformer Outage without Trilby Wash (TS1) 230/69kV Substation (2015)



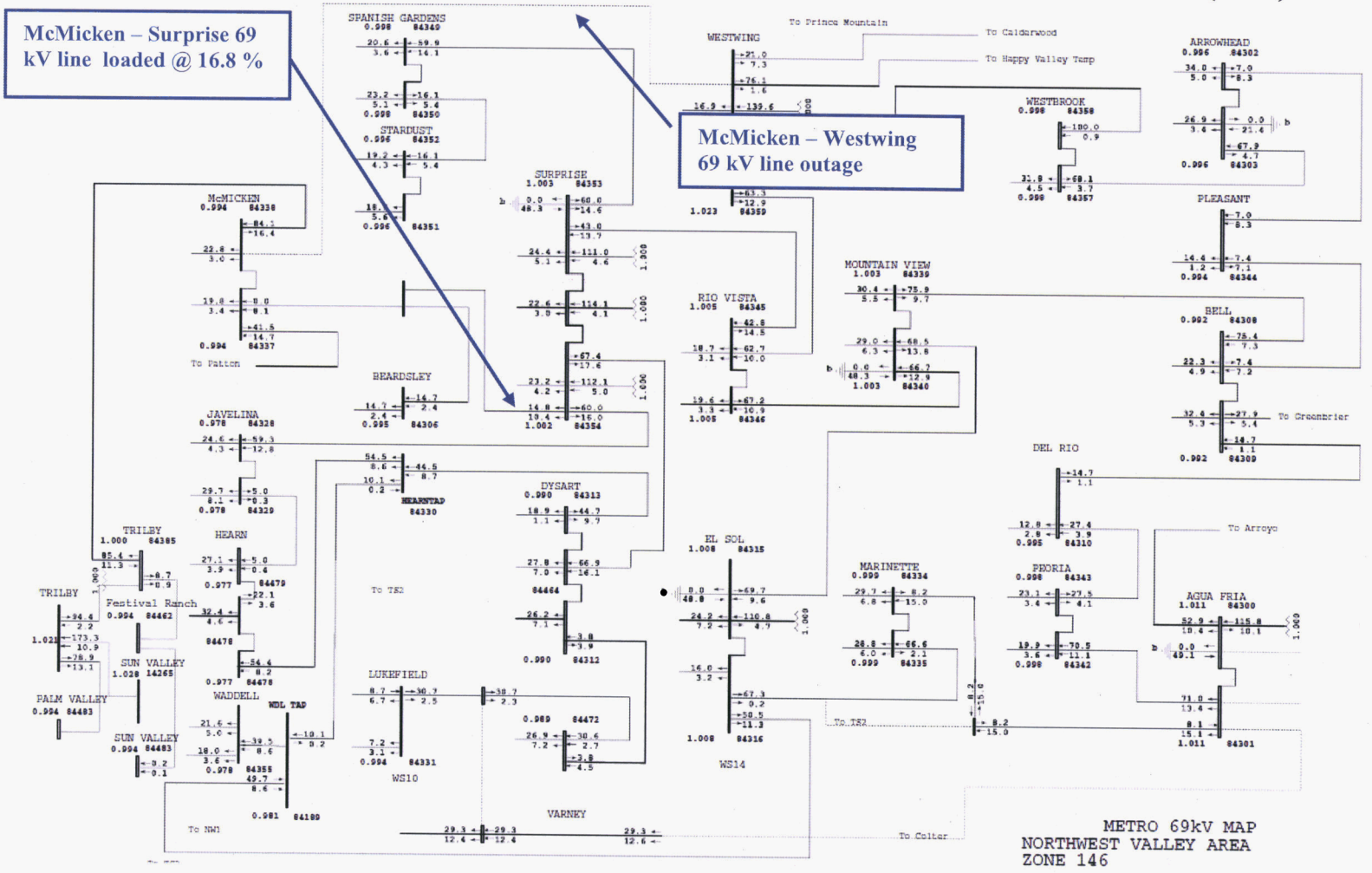
Westwing 230/69kV Transformer Outage with Trilby Wash (TS1) 230/69kV Substation (2015)



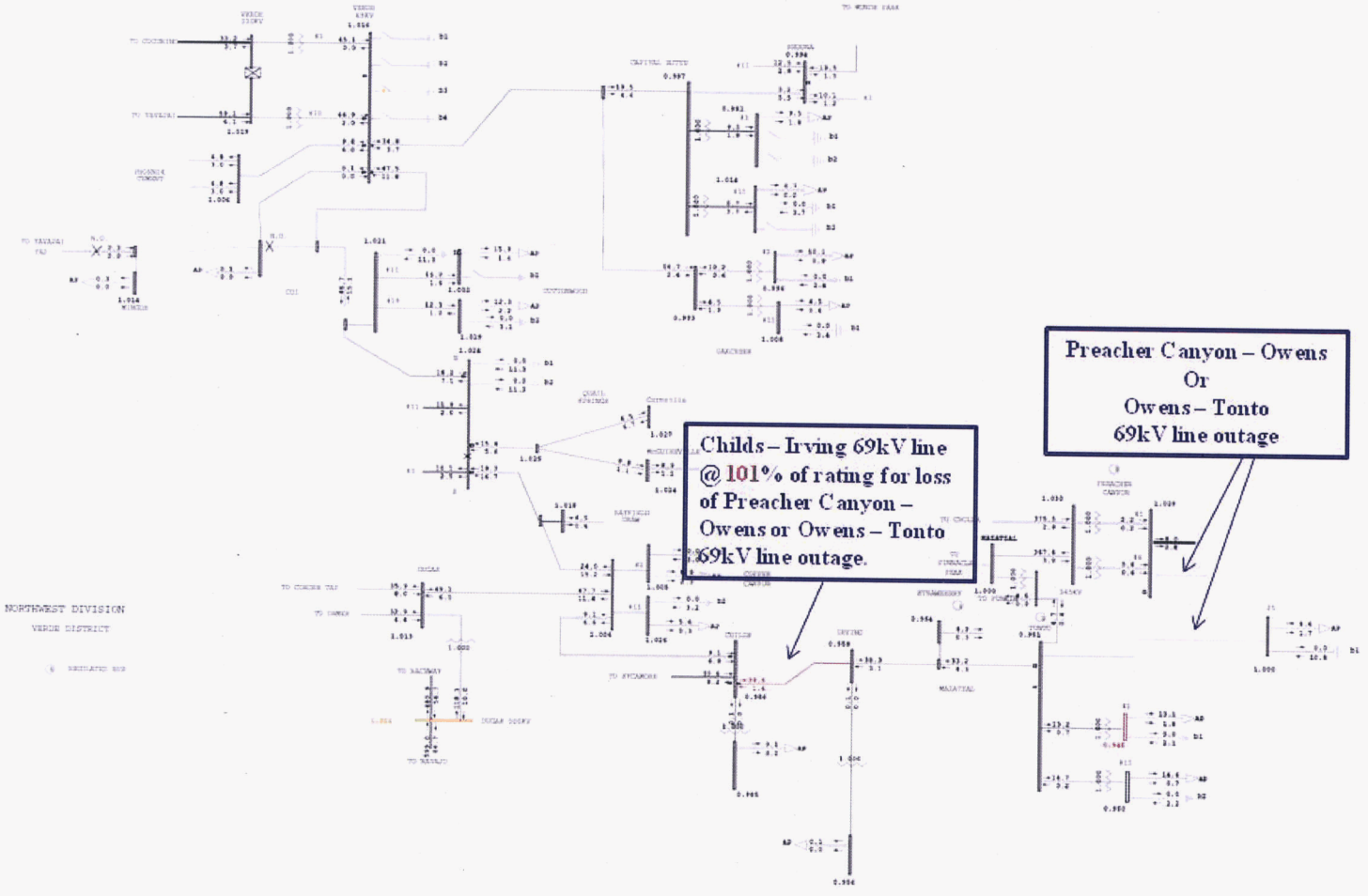
McMicken - Westwing 69kV Outage without Trilby Wash (TS1) 230/69kV Substation (2015)



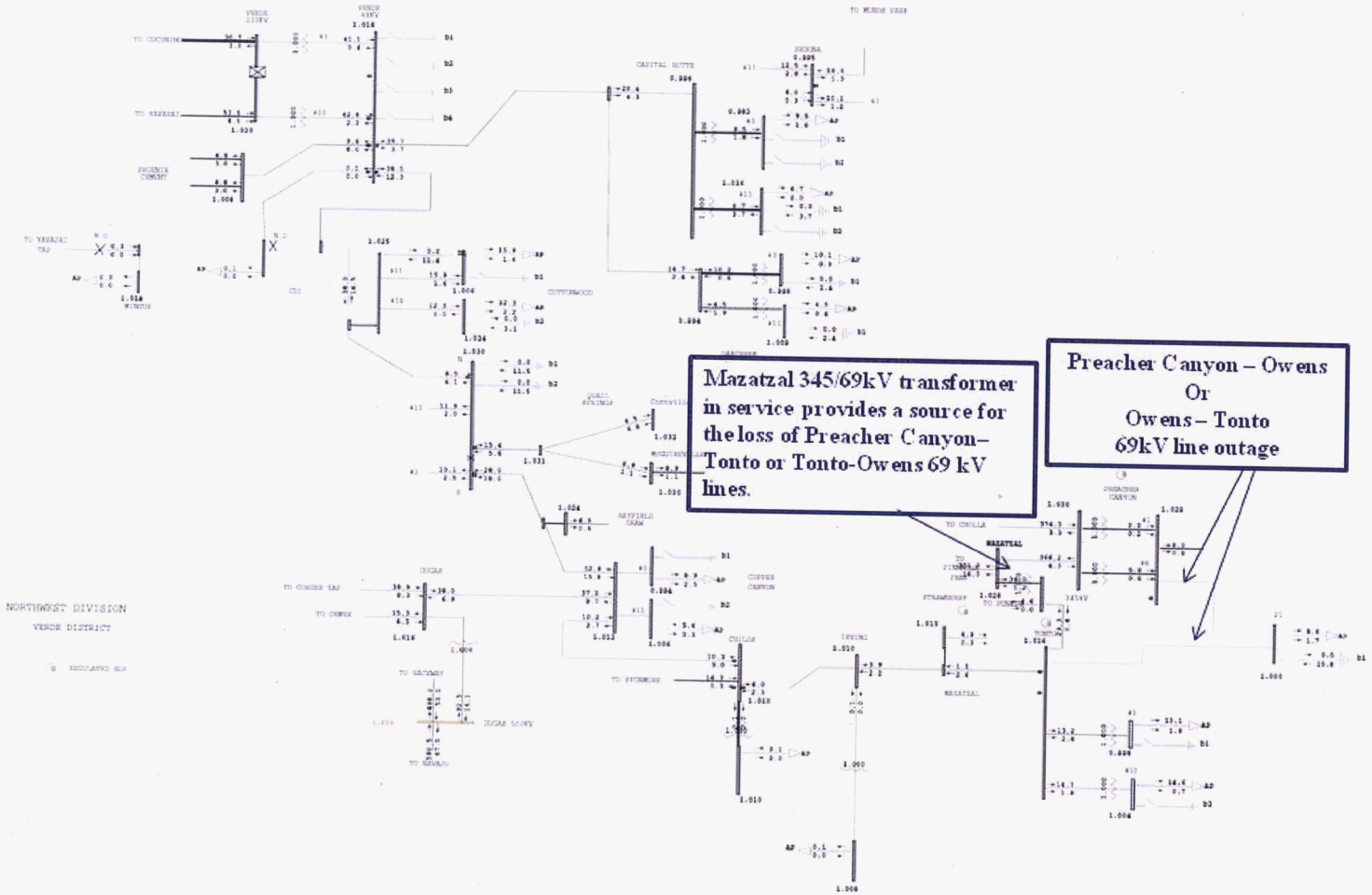
McMicken - Westwing 69kV Outage with Trilby Wash (TS1) 230/69kV Substation (2015)



Preacher Canyon – Owens – Tonto 69kV Outage without Mazatzal (2017)



Preacher Canyon – Owens 69kV Outage with Mazatzal (2017)



APPENDIX C

2014
Stability Plots

Transmission Element Outages

From bus (fault location)	To	Voltage (kV)
Abel	Pinal Central	500
Arlington	Hassyampa	500
Arroyo	Bowie	500
Avery	Scatterwash	230
Avery	Raceway	230
Cedar Mountain	Yavapai	500
Cholla	Four Corners 1	345
Cholla	Four Corners 2	345
Cholla	Pinnacle Peak	345
Cholla	Preacher Canyon	345
Cholla	Saguaro	500
Cholla	Sugarloaf	500
Coronado	Sugarloaf	500
Coronado	Silverking	500
Coronado	Springerville	345
Crystal	Navajo	500
Country Club	Grand Terminal	230
Delany	Sun Valley	500
Devers	Palo Verde	500
Dugas	Morgan	500
Dugas	Navajo	500
Four Corners	Moenkopi	500
Gila River	Jojoba 1	500
Gila River	Jojoba 2	500
Gila River	Jojoba	230
Glendale	Grand Terminal	230
Hassyampa	Hoodoo Wash	500
Hassyampa	Jojoba	500
Hassyampa	North Gila	500
Hassyampa	Palo Verde	500
Hassyampa	Pinal West	500
Jojoba	Kyrene	500
Kyrene	Browning	500
Liberty	Peacock	345
Moenkopi	Cedar Mountain	500
Moenkopi	El Dorado	500
Moenkopi	Yavapai	500
Morgan	Sun Valley	500
Morgan	Pinnacle Peak	500
Palo Verde	Delany	500
Palo Verde	Devers	500
Palo Verde	Hassyampa 1	500

Transmission Element Outages

From bus (fault location)	To	Voltage (kV)
Palo Verde	Hassyampa 2	500
Palo Verde	Hassyampa 3	500
Palo Verde	Rudd	500
Palo Verde	Westwing 1	500
Palo Verde	Westwing 2	500
Pinnacle Peak	Reach	230
Pinnacle Peak	Lonepeak	230
Pinnacle Peak	Cactus	230
Pinnacle Peak	Ocotillo	230
Silverking	Browning	500
Westwing	Yavapai	500

Substation	High-side voltage (kV)	Low-side voltage (kV)
Arroyo 1	500	345
Arroyo 2	500	345
Cholla 1	500	345
Cholla 2	500	345
Cholla 1	345	230
Cholla 2	345	230
Four Corners 1	345	230
Four Corners 2	345	230
Four Corners	500	345
Gila River	500	230
Kyrene 6	500	230
Kyrene 7	500	230
Kyrene 8	500	230
Morgan	500	230
Pinnacle Peak 1	345	230
Pinnacle Peak 2	345	230
Pinnacle Peak 3	345	230
Pinnacle Peak 1	500	230
Rudd 1	500	230
Rudd 2	500	230
Rudd 3	500	230
Rudd 4	500	230
Westwing 1	500	230
Westwing 2	500	230
Westwing	500	345
Yavapai 1	500	230
Yavapai 2	500	230

Generator Outages (Fault at Generator Terminals)

Cholla 4
Four Corners 5CC
Gila River ST1
Navajo 2
Ocotillo ST2
Palo Verde 1
Redhawk CT2 & ST1
Saguaro CT3
Sundance G3 & G4
West Phoenix North 5CT2
West Phoenix South CC1
Yucca 1

Plots provided upon request

APPENDIX D

2021
Stability Plots

Transmission Element Outages

From bus (fault location)	To	Voltage (kV)
Abel	Pinal Central	500
Arlington	Hassyampa	500
Arroyo	Bowie	500
Avery	Scatterwash	230
Avery	Raceway	230
Cedar Mountain	Yavapai	500
Cholla	Four Corners 1	345
Cholla	Four Corners 2	345
Cholla	Pinnacle Peak	345
Cholla	Preacher Canyon	345
Cholla	Saguaro	500
Cholla	Sugarloaf	500
Coronado	Sugarloaf	500
Coronado	Silverking	500
Coronado	Springerville	345
Crystal	Navajo	500
Country Club	Grand Terminal	230
Delany	Sun Valley	500
Devers	Palo Verde	500
Dugas	Morgan	500
Dugas	Navajo	500
Flagstaff	Glen Canyon	345
Flagstaff	Glen Canyon	345
Four Corners	Moenkopi	500
Four Corners	San Juan	345
Gila River	Jojoba 1	500
Gila River	Jojoba 2	500
Gila River	Jojoba	230
Glendale	Grand Terminal	230
Hassyampa	Hoodoo Wash	500
Hassyampa	Jojoba	500
Hassyampa	North Gila	500
Hassyampa	Palo Verde	500
Hassyampa	Pinal West	500
Jojoba	Kyrene	500
Jojoba	TS4	230
Kyrene	Browning	500
Liberty	Peacock	345
Mazatzal	Pinnacle Peak	345
Mazatzal	Preacher Canyon	345
Moenkopi	Cedar Mountain	500
Moenkopi	El Dorado	500
Moenkopi	Yavapai	500
Morgan	Pinnacle Peak	500
Palm Valley	Trilby Wash	230
Palo Verde	Delany	500
Palo Verde	Devers	500

Transmission Element Outages

From bus (fault location)	To	Voltage (kV)
Palo Verde	Hassyampa 1	500
Palo Verde	Hassyampa 2	500
Palo Verde	Hassyampa 3	500
Palo Verde	Rudd	500
Palo Verde	Westwing 1	500
Palo Verde	Westwing 2	500
Pinnacle Peak	Reach	230
Pinnacle Peak	Lonepeak	230
Pinnacle Peak	Cactus	230
Pinnacle Peak	Ocotillo	230
Silverking	Browning	500
Sun Valley	Delany	500
Sun Valley	Morgan	500
Westwing	Yavapai	500

Transformers (Fault on high side bus)

Substation	High-side voltage (kV)	Low-side voltage (kV)
Arroyo 1	500	345
Arroyo 2	500	345
Cholla 1	500	345
Cholla 2	500	345
Cholla 1	345	230
Cholla 2	345	230
Four Corners 1	345	230
Four Corners 2	345	230
Four Corners	500	345
Gila River	500	230
Kyrene 6	500	230
Kyrene 7	500	230
Kyrene 8	500	230
Morgan	500	230
Pinnacle Peak 1	345	230
Pinnacle Peak 2	345	230
Pinnacle Peak 3	345	230
Pinnacle Peak 1	500	230
Rudd 1	500	230
Rudd 2	500	230
Rudd 3	500	230
Rudd 4	500	230
Sun Valley 1	500	230
Sun Valley 2	500	230
Westwing 1	500	230
Westwing 2	500	230
Westwing	500	345
Yavapai 1	500	230
Yavapai 2	500	230

Generator Outages (Fault at Generator Terminals)

Cholla 4
Four Corners 5CC
Gila River ST1
Navajo 2
Ocotillo ST2
Palo Verde 1
Redhawk CT2 & ST1
Saguaro CT3
Sundance G3 & G4
West Phoenix North 5CT2
West Phoenix South CC1
Yucca 1

Plots provided upon request

Attachment B

Arizona Public Service Company
Renewable Transmission Action Plan
January 2013

In the Fifth Biennial Transmission Assessment ("BTA") Decision, (Decision No. 70635, December 11, 2008), the Arizona Corporation Commission's ("ACC" or "Commission") ordered Arizona Public Service Company ("APS" or "Company") to file a document identifying their top potential Renewable Transmission Projects ("RTPs") that would support the growth of renewable resources in Arizona. As such, on January 29, 2010, APS filed with the Commission its top potential RTPs, which were identified in collaboration with Southwest Area Transmission planning group ("SWAT") and its subgroups, other utilities and stakeholders. In its filing, APS included a Renewable Transmission Action Plan ("RTAP"), which included the method used to identify RTPs, project approval and financing of the RTPs.

On January 6, 2011, the Commission approved APS's RTAP (Decision No. 72057, January 6, 2011[1]), which allows APS to pursue the development steps indicated in the APS RTAP. The Decision, in part, ordered:

> *IT IS FURTHER ORDERED that the timing of the next Renewable Transmission Action Plan filing shall be in parallel with the 2012 Biennial Transmission Assessment process.*
>
> *IT IS FURTHER ORDERED that Arizona Public Service Company shall, in any future Renewable Transmission Action Plans filed with the Commission, identify Renewable Transmission Projects, which include the acquisition of transmission capacity, such as, but not limited to, (i) new transmission line(s), (ii) upgrade(s) of existing line(s), or (iii) the development of transmission project(s) previously identified by the utility (whether conceptual, planned, committed and/or existing), all of which provide either:*
>
> 1. *Additional direct transmission infrastructure providing access to areas within the state of Arizona that have renewable energy resources, as defined by the Commission's Renewable Energy Standard Rules (A.A.C. R14-2-1801, et seq.), or are likely to have renewable energy resources; or*
> 2. *Additional transmission facilities than enable renewable resources to be delivered to load centers.*

Renewable expansion in the APS service territory has been trending toward the development of smaller scale renewable projects. APS has received many interconnection requests for these smaller projects, which interconnect directly into the local distribution system (230kV or below) rather than APS's high voltage transmission system. Development of large scale renewable projects, which drive the need for new RTPs, has reduced dramatically since the time the APS RTAP was filed - as demonstrated by the fact that APS has received only a few transmission system interconnection requests within the last two years.

The APS 2013 Ten-Year Plan Study does not show a need for additional RTPs beyond what the Commission previously approved in Decision No. 72057. As a result, in this RTAP, APS is not proposing new RTPs. As the development of large renewable energy projects evolves, APS will explore new renewable transmission opportunities.

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[1] Commission Decision No. 72057 found that APS's 2010 RTAP process and Plan is appropriate and consistent with the Commissions Fifth Biennial Transmission Assessment final order.

Arizona Public Service Company
Renewable Transmission Action Plan
January 2013

The RTPs that APS filed in its original RTAP continue to be viable and will be developed as reliability and resource needs arise. The following section describes the RTPs (approved by the Commission in Decision No. 72057), the development approach and schedule for each, the expected cost for each, and the current status of each RTP.

1. Proposed development plan for a potential Delaney to Palo Verde 500kV project

Description: This project is one section of the Palo Verde to Sun Valley 500kV transmission line project that APS will need to import various generation resources to the Phoenix area load center. It is an integral piece to APS's 500kV infrastructure backbone in the greater Phoenix area. It also is an important component to the potential Devers II transmission project as the project establishes the Delaney switchyard. The Delaney switchyard has been identified as the starting point for the Devers II transmission project, which would provide a connection to the Southern California markets, and has the potential to enable additional renewable energy to be exported from Arizona to California.

Development Approach and Schedule: APS is pursuing the land and Right-of-Way acquisition, engineering, and construction necessary for this project. The project development activities may be adjusted to accommodate the pace of renewable energy development in the area. The actual in-service date of this project may be aligned with the first definitive use of the line. This could include an APS Purchased Power Agreement with a developer at Delaney or a committed Transmission Service Agreement with a developer selling to another utility.

Expected Cost: APS estimates the Company's portion of the project will cost $47.3 million.

Current Status: APS acquired a Certificate of Environmental Compatibility ("CEC") for the project (Decision No. 68063, August 17, 2005). APS has almost completed the land and right-of-way acquisition, design, and engineering for the project. The site preparation, grading and foundations at the Delaney switchyard have been completed. Also, APS is proceeding with engineering and construction of the new bay at the Palo Verde switchyard. In previous Ten-Year plans, APS had scheduled the project to be in-service in 2013, which assumed a firm resource development to utilize the project. Without that development, the 2013 plan shows the project with an in-service in 2016 to coincide with APS's need date for Sun Valley. APS still has four solar generation interconnection requests at the Delaney switchyard. The earliest requested interconnection date for those projects is 2016.

Arizona Public Service Company
Renewable Transmission Action Plan
January 2013

2. Proposed development plan for a potential Palo Verde to North Gila 500-kV #2 project

Description: The Palo Verde to North Gila transmission project is a potential 500kV transmission line from the Palo Verde hub area to the North Gila Substation, which is located outside of Yuma. This project will help serve the Yuma area as it will increase APS's ability to deliver various resources and increase APS's load serving capability to the load center in Yuma. The area has excellent solar conditions, which should result in comparably good pricing of solar resources. This line could enable APS to bring additional geothermal resources to APS customers from Imperial Valley in California as well as provide an opportunity for Arizona to export renewable energy.

Development Approach and Schedule: APS will continue to work toward an in-service date of 2015 for this project. APS initiated the development of this line to increase the load serving capability for, and to deliver resources to, the Yuma load center. At this time APS is the only participant in this project, however APS is open to participant involvement.

Estimated Cost: APS estimates the cost of the project will be $206.8 million.[2]

Current Status: APS has acquired a CEC for the project in Commission Decision No. 70127 (January 23, 2008). APS has nearly completed the land and right-of-way acquisition, design, and engineering for the project. Material acquisition and construction activities are expected to begin in 2013, with an expected in-service date of 2015.

3. Proposed development plan for a Palo Verde to Liberty and Gila Bend to Liberty projects

Description: The Palo Verde to Liberty and Gila Bend to Liberty are conceptual 500kV transmission line projects from the Palo Verde hub and from the Gila Bend/Gila River area to a new substation near the existing Liberty substation located in the west valley.

Current Status: To date, the APS 2013 Ten-Year Plan Studies do not show a need for these projects and, as a result, no further progress on the development plan has been made. This is primarily due to downturn in the economy and lack of renewable energy development in the area. APS will revisit these projects when renewable energy development increases in the area.

APS recovers transmission costs through APS's Formula Rate which is regulated by the Federal Energy Regulatory Commission ("FERC"). In regards to the Palo Verde to North Gila 500kV #2 project, the Company will file with FERC a request for special treatment for Construction Work In Progress, and for recovery of costs incurred if it becomes prudent to abandon the project at any point during the development process (due to participant uncertainty).

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[2] Previously this was a joint participation project with APS's participation at 40%. APS is now the only participant in the project; therefore, this cost represents 100% of the project.